Factors associated with health service utilisation in patients with systemic lupus erythematosus: a systematic review

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ABSTRACT

Objectives. *SLE patients require varying levels of health services since disease severity and activity differ among individuals. Understanding the factors associated with health service utilisation would be useful in improving equitable access. It would also help to identify modifiable factors and current good practices so as to improve quality of care and thus reduce utilisation. Thus, the objective of this review is to identify factors associated with health services utilisation.*

Methods. *Five electronic databases (PubMed, PsycINFO, EMBASE, International Pharmaceutical Abstract, Web of Science) and bibliographies of short-listed articles were searched. All indicators of health service utilisation (physician and specialist visits, hospitalisations, direct costs) and alternative medicine utilisation were accepted as outcomes in primary studies. Two authors independently selected the studies based on pre-specified inclusion and exclusion criteria.*

Results. *Of 1,276 papers retrieved from electronic and hand searches, 25 were finally selected and reviewed in totality, of which 13 were cross-sectional, 5 were prospective, and 7 were retrospective studies. A variety of service types (e.g. outpatient visits, hospitalisations, etc.) and factors (e.g. demographic, socioeconomic, laboratory indices, etc.) were evaluated. Type of health insurance, poorer physical functioning and greater disease severity were found to be associated with higher utilisation across several studies.*

Conclusion. *Modifying the choice or coverage of health insurance plans of SLE patients is a possible option in improving equitable access. Better management of patient reported outcomes such as physical functioning and timely management of SLE to reduce disease severity may reduce health services utilisation in the long term.*

Introduction

Systemic lupus erythematosus (SLE) is an autoimmune, multisystem disease with variable clinical presentations, involving virtually any organ. It is a chronic illness with a waxing and waning and unpredictable disease course with active flares and remissions. SLE commonly results in chronic debilitating ill health, but can be potentially life-threatening when major organs are affected (1). The prevalence of SLE among US adults has been estimated to be as few as 75/100,000, to as many as 150/100,000 (2). In Singapore, the prevalence of SLE has been estimated to be about 40/100,000 (3). There is a strong female preponderance with a female to male ratio of 9:1 and a peak age of between the late teens to early 40s. SLE is also more prevalent in certain ethnic groups, such as in those of African, Hispanic or Asian descent. It has been found that these patients also have poorer outcomes (4-7). The reasons for these poorer outcomes include differences in access to health care and health services utilisation (8, 9), as well as genetic, environmental and treatment differences (10).

Individual patients with SLE require highly varying levels of health services, according to each patient's level of disease activity and severity (11). The early identification of a flare and timely treatment is crucial, as treatment aimed at eliminating inflammation and/or thrombosis can reduce damage and improve prognosis (1). Hence, even patients with mild and stable disease are recommended to have quarterly lifelong follow-ups to monitor disease status (11, 12). SLE patients therefore consume considerable health services over their entire disease span.

Understanding which factors are associated with health services utilisation is valuable on several fronts. Clinically, understanding these factors helps in identifying patients who are less likely to seek and adhere to treatment. Medical under-care has been estimated to be responsible for about half of the inadequacies in evidence-based quality care (13). This is especially relevant to SLE patients because of the need for regular monitoring and prompt management. From a social perspective, such factors indicate whether access to healthcare is equitable. Equitable access has been defined as occurring when demographic and need factors (*e.g.* age, disease factors) account for differing levels of utilisation, rather than social characteristics and enabling resources (*e.g.* education, income) (14). Identification of modifiable factors also allows healthcare administrators to address issues of underutilisation or overutilisation. Policy makers, insurers and healthcare administrators, in evaluating policies or programs, also consider their effect on health services utilisation (15). Identifying healthcare providers or programs associated with improved health services utilisation would also be valuable in identifying good clinical practices. Hence, the objective of this systematic literature review is to identify the factors associated with health services utilisation in patients with SLE.

Methods

Definitions

We performed an extensive search by adopting a broad definition of "health services utilisation". All health service types provided by both Western and traditional/ alternative medicine practitioners were included in this definition. We chose to include traditional/ alternative health services as the factors associated with these may differ from those for Western health services. Furthermore, dissatisfaction with either type of health services may prompt patients to switch to another type of health services. Hence, excluding either type of health service would potentially result in an incomplete perspective of factors associated with health services utilisation. Measures of utilisation included frequency (*e.g.* number of visits per year) and cost data (*e.g.* direct costs).

Inclusion and exclusion criteria

Papers were included if they 1) presented original data; 2) studied patients with SLE; 3) investigated factors associated with health services utilisation as independent variables; and 4) measured utilisation as a study outcome. Meeting abstracts and letters were excluded. Studies were also excluded if they 1) did not perform subgroup analyses for SLE patients in studies involving patients with other medical conditions and 2) investigated effects of a specific intervention on utilisation.

Search strategy

A search was undertaken in the following electronic databases: PubMed; PsycINFO; EMBASE; International Pharmaceutical Abstract and Web of Science (Science Citation Index, Social Sciences Citation Index, and Arts & Humanities Citation Index) with the search terms "cost", "costs", "economic", "economics", "utilisation", "utilisation" and "access to care" used in combination with "lupus". The bibliographies of articles short-listed from database searches were further hand searched for other relevant articles.

Two investigators independently assessed the titles and abstracts identified by the literature search using explicit inclusion and exclusion criteria as described above. Differences were resolved by consensus. Articles meeting the inclusion criteria were retrieved and reviewed in entirety by OYL. Further exclusion of studies following full-text review was based on the same criteria, and the remaining studies were included for review.

Data extraction and synthesis

Data from each study were abstracted into Table I that detailed key information, including authors, country, study design, data and recruitment source, factors evaluated, statistical analysis methods, measures of utilisation, and factors found to be associated with higher utilisation (*i.e.* statistically significant in multivariate analyses). Substantial variation in study design and outcomes assessed precluded a meta-analysis of these 25 studies.

Results

Studies included in review

Of the 1,278 titles and abstracts identified from the electronic databases, 52 full-text articles were retrieved and reviewed. The search results and reasons for exclusion were detailed in Figure 1. Eight hundred and seventy-three articles were excluded because they did not investigate a SLE patient population. Eventually, 25 articles met the inclusion criteria and were included for review. A summary of key data from these articles was given in Table I. Five additional titles and abstracts were identified from the bibliographies of these articles with none meeting the inclusion criteria for review.

The studies were carried out between 1987 and 2005. Most studies were performed in the United States (n=13). The other studies were from Singapore (n=2), Canada (n=2), Germany (n=1), Mexico (n=1), the United Kingdom (n=1), Puerto Rico (n=1), a bi-national study involving the US and Canada, and three tri-national studies involving the US, the UK and Canada. Of the 25 studies, 13 were cross-sectional and 5 were prospective, and another 7 were retrospective studies.

Three study groups (the University of California, San Francisco Lupus Outcomes Study (UCSF LOS) (16-20); Montreal General Hospital (MGH) Study (21, 22); Tri-National Study (23-25) accounted for ten of these 25 studies. Additionally, one study incorporated the results of the MGH Study and used a similar methodology in Stanford in order to compare utilisation between US and Canada (26). For the purpose of this review, all studies were treated as independent studies since each study reported the effects of distinct factors. However, care was taken in interpreting the results arising from studies using the same dataset to prevent duplicate counts of factors being evaluated.

Measures of utilisation

The outcome measures of health services utilisation used by the studies reviewed were highly varied, and could

Table I. Summary of studies included in this review.

Study	Country; sample size; study design	Data collection; recruitment source	Factors evaluated	Statistical analysis	Measures of health services utilisation	Factors associated with higher utilisation[‡]
Julian *et al*. (2009)	US; n=834; Cross-Sectional Study	Phone surveys; UCSF LOS (clinical & community-based sources)	Primary: Attitudes/social/behavioral: Medication adherence (medication forgetfulness) Covariates: Age, ethnicity, sex, marital status, education, poverty status, disease duration, disease activity, recent flare, number of medications, cognitive dysfunction, depressive symptoms	Hierarchical logistic regression	Any visit per year: Rheumatologist, generalist, ER, hospitalisations	Medication adherence ($p=0.03$): ER visits
Carls *et al*. (2009)	US; n=6,269 (5,677 without nephritis, 592 with nephritis); Retrospective Database Study	Thomson Reuters MarketScan Commercial Claims and Encounters Database; Employees and dependents of over 100 large employers in the US	Disease-specific: presence of lupus nephritis	Standard descriptive statistics. *t*-test	Annual direct costs: Inpatient admissions, ER visits, outpatient office visits, prescription drugs	Presence of lupus nephritis: SLE patients with nephritis incurred almost four times higher direct costs than SLE patients without nephritis
Panopalis *et al*. (2008)	US; n=812; Cross-Sectional Study	Phone surveys; UCSF LOS (clinical & community-based sources)	Demographic: age, ethnicity, sex, marital status Socioeconomic: education General health: health status Disease-specific: disease activity, disease duration	Multiple linear regression, Log-transformation of costs to reduce skewness	Annual direct costs: Physician visits by specialty, visits to other health care professionals, acute and long-term care hospitalisations, ER services, outpatient surgical procedures, dialysis, medications	Younger age ($p=0.032$), poorer physical functioning ($p=0.000$), poorer mental functioning ($p=0.000$), greater disease activity ($p=0.007$), longer disease duration ($p=0.000$)
Clarke *et al*. (2008)	US, UK, Canada; n=715; Prospective Study	Physical examination, questionnaires; Consecutive patients attending tertiary care centers	Primary: Disease-specific: presence of renal damage (Model 1 predictor variable: renal subscale of the SLICC/ACR DI; Model 2 predictor variables: decreased glomerular filtration rate or proteinuria, decreased glomerular filtration rate and proteinuria, end-stage renal disease) Covariates: Age, ethnicity, sex, marital status, education, health status, disease activity, disease severity, disease duration, social support, satisfaction with medical care, country of healthcare delivery	Simultaneous regression, Log-transformation of costs to reduce skewness	Annual direct costs: (assessed using the economic portion of the modified Stanford HAQ[a], Societal Perspective)	Renal damage: Model 1: renal subscale of the SLICC/ACR DI ($p<0.05$) Model 2: decreased glomerular filtration rate and proteinuria ($p<0.05$), end-stage renal disease ($p<0.05$)
Ward *et al*. (2008)	US; n=8,670; Retrospective Database Study	State Department of Health Statewide Planning and Research Cooperative System Database; Patients hospitalised in all acute-care, non-federal New York hospitals	Demographic: age, ethnicity, sex Socioeconomic: health insurance plan (private, Medicare, public, unknown, no insurance), residence in a rural country, socioeconomic status score Others (hospital-related): number of beds, hospital volume, physician volume	Multivariate logistic regression	Number of avoidable hospitalisations: (Avoidable hospitalisations were identified as ruptured appendix, asthma, cellulitis, congestive heart failure, diabetes mellitus out of control, gangrene, hypokalemia, common communicable diseases for which immunisation exist, malignant hypertension, pneumonia, pyelonephritis, perforated or bleeding ulcer	Older age ($p=0.04$), Medicare insurance ($p=0.001$), low socioeconomic status ($p=0.02$), low-volume hospital ($p=0.0002$)
Molina *et al*. (2008)	Puerto Rico; n=757; Retrospective Database Study	Triple-S, Inc. insurance claims database; Corporate or individual patients privately insured with Tripe-S, Inc.	Primary: Others: health care provider (primary care physicians vs. rheumatologists)	Chi-squared tests, Fischer exact tests, ANOVA	Any visit per year: and Mean visits per year: Office visits to a rheumatologist or primary care physician, ER, hospitalisations Laboratory tests: Complete blood count, basic metabolic panel, comprehensive metabolic panel, ESR, urinalysis, creatinine clearance, C-reactive protein, serum complements, complement activity, anti-dsDNA antibodies, anticardiolipin antibodies Prescription drugs: NSAIDs, COX-2 inhibitors, glucocorticoids, hydroxychloroquine, azathioprine, cyclophosphamide, methotrexate, mycophenolate mofetil, dapsone, danazol, cyclosporine	Laboratory tests: Rheumatologists: ordered more ESR ($p<0.05$), anti-dsDNA antibodies ($p<0.05$), serum complement ($p<0.01$) tests Prescription drugs: Rheumatologists: prescribed hydroxychloroquine ($p<0.01$) more frequently

Study	Country; sample size; study design	Data collection; recruitment source	Factors evaluated	Statistical analysis	Measures of health services utilisation	Factors associated with higher utilisation[‡]
Gillis *et al*. (2007)	US; n=920; Cross-Sectional Study	Phone surveys; UCSF LOS (clinical & community-based sources)	Primary: Socioeconomic: health insurance plan (Medicaid insurance solely VS all other forms of insurance) Covariates: Age, ethnicity, urban/non-urban locale, education, disease severity, distance to SLE provider	Multiple linear and logistic regression	Any visit per year: and Mean visits per year: To a Rheumatologist, generalist for any indication, generalist for SLE, ER for any indication, or ER for SLE	Any visit per year: Medicaid only ($p<0.05$): Generalists & ER for SLE, ER for any indication Mean visits per year: Medicaid only ($p<0.05$): Generalists & ER for any indication and for SLE
Yazdany *et al*. (2007)	US; n=867; Cross-Sectional Study	Phone surveys; UCSF LOS (clinical & community-based sources)	Demographic: age, ethnicity, sex Socioeconomic: education, health insurance plan, income Disease-specific: disease activity, disease severity Others: subject recruitment source (rheumatology practice vs. community-based efforts)	Multiple logistic regression	Any visit per year: To a Rheumatologist	Younger age ($p=0.04$), female sex ($p<0.0001$), higher income ($p=0.03$), greater disease severity ($p=0.05$)
					Identification of any specialist as primarily responsible for SLE care	Younger age ($p=0.07$), higher income ($p=0.03$)
Yelin *et al*. (2007)	US; n=729; Cross-Sectional Study	Phone surveys; UCSF LOS (clinical & community-based sources)	Primary: Socioeconomic: health insurance plan (Health Maintenance Organisation *vs*. Fee-For-Service) Co-variates: Age, ethnicity, sex, marital status, ducation, poverty status, health status, BMI, smoking status, co-morbid conditions, disease activity, disease severity	Multiple linear and logistic regression ($R^2 = 0.19$ for total physician visits model)	Mean visits per year: To a physician, non-physician, generalist or rheumatologist Any visit per year: To a nephrologist, pulmonologist, dermatologist, physical therapist, ER, outpatient surgical, hospital stay Diagnostic Tests per year: Tomography, MRI, PFT, bone density scan Current Medication Usage	Fee-For-Service participants ($p<0.05$): Total ambulatory visits to all physicians, non-physicians, dermatologists, physical therapists, outpatient surgery, bone density scans
Huscher *et al*. (2006)	Germany; n=844; Cross-Sectional Study	Questionnaires, National Database of the German Collaborative Arthritis Centres; Patients from 24 arthritis centers enrolled in database	Socioeconomic: education General health: health status Disease-specific: disease activity, disease duration	Multiple linear regression	Annual direct costs: Physician visits, drug and non-drug treatments, surgery, imaging techniques, inpatient stays in acute care hospitals and rehabilitation clinics, out-of-pocket patient expenditures for disease-related expenses (Societal Perspective)	Greater disease activity, poorer physical functioning ($p<0.05$)
Krishnan *et al*. (2006)	US; n=76,961 (hospitalisations); Retrospective Database Study	US Healthcare Cost Utilisation Project Database; Hospitalisations for SLE in US acute care community hospitals	Demographic: age, sex Socioeconomic: health insurance plan, income General health: number of medical conditions Others: number of medical procedures, length of stay	Median regression (with bootstrapping)	Hospital charges per inpatient stay: Not inclusive of charges billed by the physician or medications prescribed at the time of discharge	Younger age, male sex, higher income, greater number of medical conditions, longer hospital stay, more medical procedures ($p<0.05$) Medicare insurance was associated with lower utilisation
Nichol *et al*. (2004)	US; n=2395; Retrospective Database Study	Medi-Cal Fee-for-Service Claims; California Medicaid Lupus population	Primary: Demographic: ethnicity (White, Black, Hispanic) Co-variates: Age, sex, aid type, dual eligibility to Medicare and Medi-Cal	Mixed regression modeling (with averaging of monthly cost over a quarter to reduce skewness)	Direct cost per patient-month: Inpatient/nursing/ intermediate facility, outpatient/ physician/ medical supply, prescription costs (Insurer's perspective)	Hispanic x length of care interaction reported lower utilisation ($p<0.0001$) (*i.e*. total costs were lower with lengthier periods of care as compared to Whites and African-Americans)
Edwards *et al*. (2003)	Singapore; n=348; Retrospective Database Study	Hospital admissions database, discharge summaries, case notes; Hospitalisations at a tertiary referral centre for SLE	Demographic: age, ethnicity, sex General health: co-morbid conditions Disease-specific: previous organ manifestations (disease severity), previous, present & treatment at discharge, date of SLE diagnosis, number of ACR criteria Others: reason for hospital admission	Standard descriptive statistics (mean and standard deviation)	Length of hospital stay	Presence of co-morbid conditions ($p=0.05$), multiple clinical indications for admission ($p<0.01$)
				COX regression	Readmission to hospital: Within a 12-month study period	Active nephritis ($p<0.01$), flare of lupus ($p<0.01$), more ACR criteria ($p<0.01$)

Study	Country; sample size; study design	Data collection; recruitment source	Factors evaluated	Statistical analysis	Measures of health services utilisation	Factors associated with higher utilisation[‡]
Leong *et al*. (2003)	Singapore; n=191; Cross-Sectional Study	Questionnaires; Consecutive Chinese patients attending a rheumatology clinic	Demographic: age, sex, marital status, first language Socioeconomic: education, occupation Disease-specific: age of diagnosis, perception of disease severity Attitudes/social/behavioral: attitude towards disease & treatment	Multiple logistic regression (backward elimination for variable entry)	Any use in patient's lifetime: Alternative medicine (for general health or SLE disease)	General health users: Perception of milder disease ($p<0.10$) Disease-specific users: Perception of milder disease, Chinese as first language, greater learned helplessness, earlier age of diagnosis ($p<0.10$)
Sutcliffe *et al*. (2001)	UK; n=105; Cross-Sectional Study	Physician examination, questionnaires; Consecutive patients attending a specialised SLE clinic	Demographic: age, ethnicity, sex, marital status Socioeconomic: education General health: health status Disease-specific: disease activity, disease severity, disease duration Attitudes/social/behavioral: social support, satisfaction with medical care	Multiple linear regression (with bootstrapping)	Annual direct costs: (assessed using the economic portion of the modified Stanford HAQ[a], Societal Perspective)	Younger age, higher education, poorer physical functioning, greater disease activity, greater disease severity ($p<0.05$)
Moore *et al*. (2000)	US, UK, Canada; n=707; Cross-Sectional Study	Physical examination, questionnaires; Consecutive patients attending tertiary care centers	Demographic: age, ethnicity, sex, marital status Socioeconomic: education General health: health status Disease-specific: disease activity, disease severity, disease duration, Attitudes/social/behavioral: social support, satisfaction with healthcare Others: direct costs and indirect costs	Standard descriptive statistics (mean and standard deviation)	Any use in past 6 months: Alternative medicine	Younger age, higher education, poorer vitality, role physical, shorter disease duration, lower satisfaction with medical care ($p<0.05$)
Clarke *et al*. (1999)	US, UK, Canada; n=708; Cross-Sectional Study	Physical examination, questionnaires; Consecutive patients attending tertiary care centers	Primary: Others: country of healthcare delivery Co-variates: Age, ethnicity, sex, marital status, education, health status, disease activity, disease severity, social support, satisfaction with medical care, country-specific SF-36 general population norms	2-stage multiple linear and logistic regression, Log-transformation of costs to reduce skewness	Utilisation: Specialist, generalist, lab/imaging procedures, medication, ER, outpatient surgery, acute hospital stay, length of stay Cost: Specialist, generalist, lab/imaging procedures, medication, acute hospital stay	US: Higher lab/ imaging and ER utilisation ($p<0.05$) Canada: Specialist costs UK: Generalist costs US: Lab/imaging costs, acute hospital care hospital costs ($p<0.05$)
Rojas-Serrano *et al*. (2000)	Mexico; n=180; Cross-Sectional Study	Physical examination, laboratory assessment, questionnaires; Consecutive patients presenting at a hospital emergency unit	Demographic: age Socioeconomic: education, income Disease-specific: disease activity, disease severity, drug therapy, age at diagnosis, age at first symptom Attitudes/social/behavioral: depression & anxiety Others: reason for consultation, compliance with medical appointments/medication/lab assessments, alcohol/ tobacco/ illicit dug use	Multiple logistic regression (stepwise selection for variable entry)	Any hospitalisation: Upon presentation to the emergency room	Greater disease severity (physician global assessment ($p<0.0001$); and SLICC ACR-DI scores ($p<0.01$)), fewer ACR criteria fulfilled ($p<0.001$)
Alarcón *et al*. (1999)	US; n=229; Cross-Sectional Study	Physical examination, medical records, questionnaires; Recent onset SLE patients (<5 years) from 3 institutions and referrals from community rheumatologists	Primary: Demographic: ethnicity (Hispanic, African-American, Caucasian) Co-variates: Age, sex, marital status, education, health insurance plan, income, occupation, housing, literacy, health status, disease activity, disease severity, disease duration, fatigue, pain, social support, attitude towards disease and treatment, illness coping, immunologic, health habits	ANOVA	Number of visits: Healthcare providers	None

Study	Country; sample size; study design	Data collection; recruitment source	Factors evaluated	Statistical analysis	Measures of health services utilisation	Factors associated with higher utilisation[‡]
Katz *et al*. (1998)	US; n=2105; Retrospective Database Study	Medicare claims data; Elderly (>65 years) Medicare population	Demographic: age, ethnicity, sex, sex-race interaction Others: state (Colorado, Massachusetts, Virginia)	Multiple logistic regression	Any referral to a rheumatologist per year	Virginia State (p=0.0001) African-American female reported lower utilisation (p=0.003)
Gironimi *et al*.[b] (1996)	US, Canada; n=338; Prospective Study	US: Questionnaires; Patients enrolled in the ARAMIS Stanford lupus databank Canada: Refer to Lacaille 1993/ Clarke 1994	Primary: Others: country of healthcare delivery Co-variates: Age, ethnicity, sex, marital status, education, employment, physical functioning, global well-being, disease duration, serum creatinine	Multiple linear regression (stepwise selection for variable entry)	Mean number per year: Diagnostic procedures, physician visits Expenditure per year: Medication	Canada: Medications (p=0.01)
Waters *et al*. (1996)	US; n=119; Cross-Sectional Study	Questionnaires; Consecutive patients attending 2 urban hospital clinics	Demographic: age, ethnicity Socioeconomic: coinsurance rate General health: health status Disease-specific: length of time from first symptom to diagnosis Attitudes/social/behavioral: attitude towards disease and treatment Others: number of rheumatologists within a 5-mile radius	Multiple linear and logistic regression	Mean visits per year: To a Physician Any hospitalisation per year	Lower coinsurance rate (p<0.10), poorer physical functioning (p<0.01), negative attitude towards disease and treatment (p<0.05) Younger age (p<0.05), poorer physical functioning (p<0.05)
Lacaille *et al*. (1994)	Canada; n=150 Prospective Study	Physical examination, laboratory assessment, history, questionnaires; Patients enrolled in the MGH Lupus Registry	Primary: Disease-specific: disease activity, drug therapy, global disease severity (renal, CNS, hematological systems) Covariates: Age, ethnicity, sex, marital status, income, employment-education interaction, health status, disease duration, social support	Multiple linear regression, Log-transformation of costs (stepwise selection for variable entry) (R^2 = 0.22)	Annual direct costs: (assessed using the economic portion of the modified Stanford HAQ[a], Societal Perspective)	Poorer physical functioning (p=0.0001), greater disease severity (p=0.004), shorter disease duration (p=0.04)
Clarke *et al*. (1993)	Canada; n=155; Prospective Study	Physical examination, laboratory assessment, history, questionnaires; Patients enrolled in the MGH Lupus Registry	Demographic: age, ethnicity, sex, marital status Socioeconomic: income, employment-ducation interaction General health: health status Laboratory indices: serum creatinine value, hemoglobin level, platelet count, ESR Disease-specific: disease duration Attitudes/social/behavioral: social support Others: previous year direct & indirect costs	Multiple linear regression, Log-transformation of costs (stepwise selection for variable entry) (R^2 = 0.34)	Annual direct costs: (assessed using the economic portion of the modified Stanford HAQ[a], Societal Perspective)	Unmarried (p=0.0587), poorer level of physical functioning (p=0.0059), higher serum creatinine (p=0.0001), poorer social support (p=0.0178), greater previous year direct costs (p=0.0007)
Petri *et al*. (1992)	US; n=261; Prospective Study	Physical examination, laboratory assessment, phone interviews; Patients enrolled in the Hopkins Lupus Cohort	Demographic: age ethnicity, sex Socioeconomic: education, health insurance plan, Laboratory indices: presence of proteinuria, WBC, ESR, C3 protein, C4 protein, Anti-DNA, creatinine Disease-specific: disease activity, disease duration, prednisone dose	Multiple logistic regression	Any hospitalisation per year: For active SLE (n = 38) Any hospitalisation per year: For infection (n = 38)	Greater disease activity (p=0.04), immunosuppressive drug use in preceding year (p=0.06), higher WBC in preceding year (p=0.01) Greater disease activity (p=0.07), higher ESR (p=0.02), lower C3 (p=0.06), higher creatinine (p=0.03), neurologic involvement in preceding year (p=0.02), anti-hypertensive treatment in preceding year (p=0.03)

[a] Utilisation components of the Stanford HAQ: Number of outpatient visits to physicians and other healthcare professionals, mode of transportation, assistance required to facilitate each visit, outpatient usage of prescription and non-prescription medication, other therapies, medical assistive devices, outpatient radiologic and laboratory diagnostic procedures, visits to emergency room and mode of transportation, usage of outpatient surgery facilities, stays in hospitals or nursing homes.

[b] Study incorporating the results of the MGH lupus cohort study with utilisation data from the Stanford SLE patient sample.

[‡] After adjusting for potential covariates in multivariate analyses.

be broadly classified into five categories: direct costs (n=10) (20-23, 25-30), physician visits (n=7) (16, 18, 19, 23, 26, 31, 32), hospitalisations (n=11) (16, 18, 19, 23, 31-37), use of specialty care (n=5) (17, 19, 23, 32, 38), and use of alternative medicine (n=2) (24, 39). The outcome measure of utilisation was vague in one study (described as "number of visits to a healthcare provider") (40). Multiple outcomes were often investigated within a single study.

Among studies that used direct costs as the primary outcome measure, poorer physical functioning (20-22, 27, 29), greater disease activity (20, 27, 29), greater disease severity (22, 29), younger age (20, 29), being unmarried (21), higher education (29), poorer social support (21), poorer mental functioning (20), shorter (22) or longer (20) disease duration, presence of lupus nephritis (30) or renal damage (25), and having higher serum creatinine (21) were associated with higher direct costs. Interestingly, an interaction between Hispanics and length of care was observed, where total costs were lower with lengthier periods of care as compared to Whites and African-Americans. Among studies that used the number of physician/ambulatory visits as primary outcomes, health insurance status (16, 18, 31), poorer physical functioning (31) and negative attitude towards disease and treatment (31) were significantly associated with higher utilisation. Among studies that used hospitalisation as a primary outcome measure, greater disease severity (36), fewer ACR criteria fulfilled (36), younger age (31), poorer physical functioning (31), greater disease activity (35), previous immunosuppressive drug use (35), history of higher WBC (35), higher ESR (35), lower C3 (35), higher creatinine (35), history of neurologic involvement (35) and history of anti-hypertensive treatment (35) were significantly associated with higher utilisation.

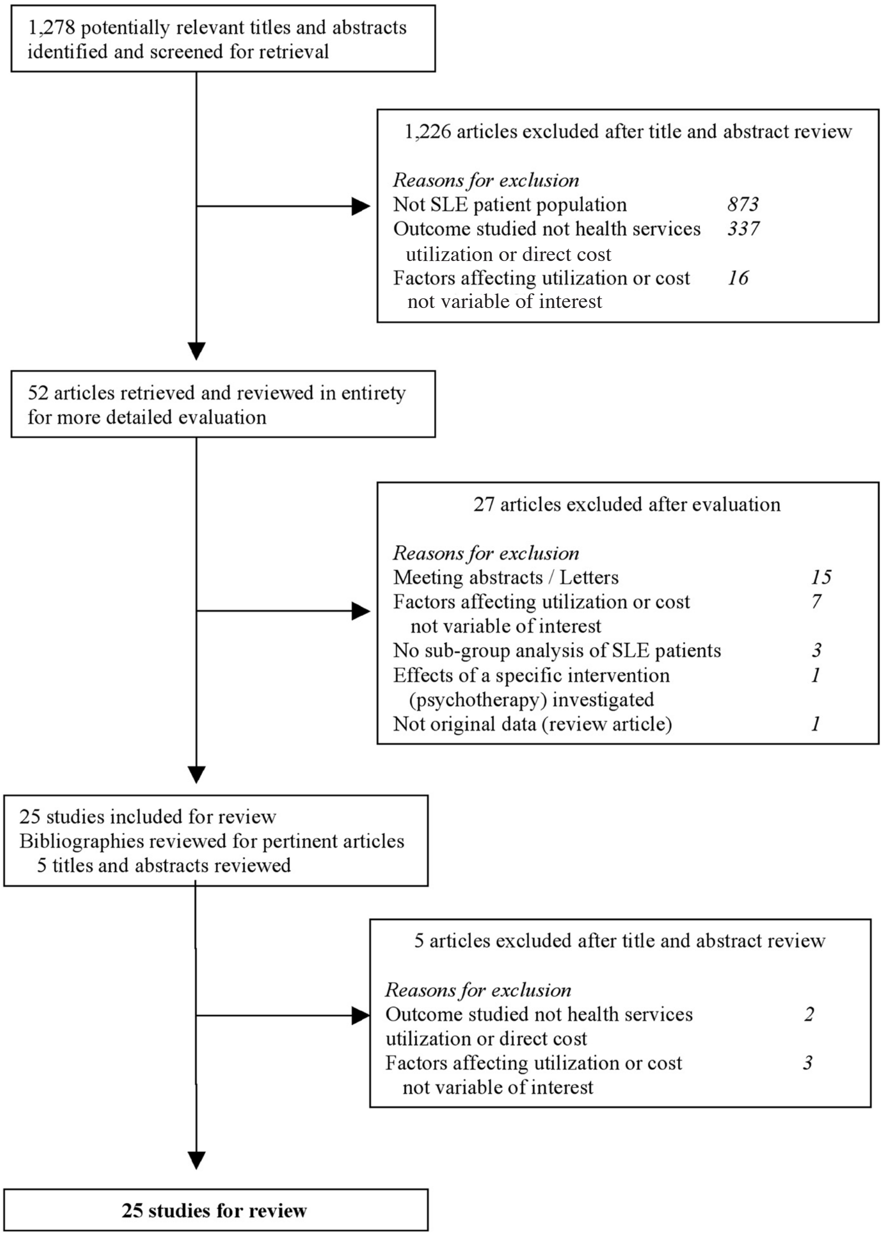

Fig. 1. Flowchart of the systematic literature search process.

Factors investigated

A wide variety of factors was considered in the 25 studies and could be classified into seven broad categories. These are discussed in detail below. In addition, those findings that were statistically significant are summarised and presented in Table II. Ten studies evaluated a single factor: ethnicity (28, 40), health insurance plan (16, 18), country of healthcare delivery (23, 26), type of health care provider (rheumatologist *vs.* primary care physician) (32), presence of lupus nephritis (30) or renal damage (25), and medication adherence (19) while controlling for co-variates. The remaining studies investigated multiple factors within the same study.

Demographic factors

In the 13 studies that evaluated the association between age and health services utilisation (17, 20, 21, 24, 29, 31, 33-39), younger age was found to be associated with higher utilisation in six studies (17, 20, 24, 29, 31, 34). However, in one study by Ward *et al.*, older patients were found more likely to have avoidable hospitalisations (37). Ethnicity was not associated with health services utilisation in any of the twelve studies investigating its effect (17, 20, 21, 28, 29, 31, 33, 35-38, 40). However, it was interesting that one study (38) found that African-American females were less likely to be seen by a rheumatologist (adjusted odds ratio; 95%CI): white Massachusetts male *vs.*

Table II. Factors significantly associated with higher health services utilisation.

Factors	Studies (Author, year)	Major conclusions
Demographic factors		
Age	Panopalis *et al*. (2008)	Younger patients were: associated with higher direct costs (adjusted coefficient per year, *p*-value): -0.007, 0.032.
	Ward *et al*. (2008)	less likely to have avoidable hospitalisations (adjusted odds ratio, *p*-value): <35 years (reference group); 35-44 years (1.22,0.04); 45-54 years (1.38,0.0003); 55-64 years (1.57,<0.0001); ≥65 years (1.84,<0.0001).
	Yazdany *et al*. (2007)	more likely to visit a rheumatologist (adjusted odds ratio, p-value): <30 years (reference group); 31-40 years (1.08,0.83); 41-50 years (0.71,0.32); 51-64 years (0.43,0.01); ≥65 years (0.43,0.04). identify any specialist as being primarily responsible for SLE care (adjusted odds ratio, *p*-value): <30 years (reference group); 31-40 years (0.68,0.39); 41-50 years (0.59,0.21); 51-64 years (0.32,0.006); ≥65 years (0.27,0.007).
	Sutcliffe *et al*. (2001)	associated with higher direct costs (adjusted coefficient (£) per year, *p*-value): -38.9, <0.05.
	Moore *et al*. (2000)	more likely to be users of alternative medicine (mean difference per year, *p*-value): 2.0, <0.05.
	Krishnan *et al*. (2006)	were associated with higher hospital charges (adjusted coefficient per year, *p*-value): -12, <0.05.
	Waters *et al*. (1996)	were more likely to be hospitalised (adjusted odds ratio per year, *p*-value): 0.79, <0.05.
Sex	Yazdany *et al*. (2007)	Female patients were: more likely to visit a rheumatologist (adjusted odds ratio, *p*-value): 2.61, <0.0001.
	Krishnan *et al*. (2006)	associated with lower hospital charges (beta coefficient, *p*-value): -236, <0.05.
Marital Status	Clarke *et al*. (1993)	Married patients were associated with lower direct costs (adjusted coefficient (CAD$), *p*-value): -274.46, 0.0587.
Ethnicity – Gender Interaction	Katz *et al*. (1998)	African-American female patients were less likely to be referred to a rheumatologist (adjusted odds ratio, *p*-value): white Massachusetts male *vs*. African-American female (0.53, 0.003) (as compared to White male, White female and African-American male patients).
Ethnicity – Length of care Interaction	Nichol *et al*. (2004)	Hispanic patients were associated with lower direct costs with increasing length of care (*p*-value = <0.0001) (as compared to White and Black patients).
Socioeconomic factors		
Health Insurance Plan	Ward *et al*. (2008)	Medicare patients were associated with more avoidable hospitalisations (adjusted odds ratio, *p*-value): private insurance (reference group); Medicare (1.27, 0.001); public insurance (1.13, 0.11); no insurance (1.14, 0.37); unknown insurance (0.80, 0.61).
	Gillis *et al*. (2007)	Medicaid-only patients were associated with more visits to: generalists (adjusted odds ratio, *p*-value): 3.78, <0.05 emergency rooms (adjusted odds ratio, *p*-value): 2.40, <0.05 (as compared to patients with all other forms of insurance).
	Yelin *et al*. (2007)	Fee-For-Service participants were associated with more total ambulatory visits to physicians (mean difference, *p*-value): 2.3,<0.05 non-physicians (mean difference, *p*-value): 3.1, <0.05 (as compared to Health Maintenance Organization participants).
	Krishnan *et al*. (2006)	Medicare patients were associated with lower hospital charges (beta coefficient, *p*-value): Medicare (reference group); Medicaid (296, <0.05); private insurance (602, <0.05), other (472,<0.05) (as compared to patients with Medicaid, private or other forms of insurance).
	Waters *et al*. (1996)	Patients with higher coinsurance rates were associated with fewer physician visits (adjusted coefficient, *p*-value): -0.02, <0.10.
Education	Sutcliffe *et al*. (2001)	Patients with higher education were: associated with higher direct costs (adjusted coefficient (£), *p*-value): 204.6, <0.05.
	Moore *et al*. (2000)	more likely to use alternative medicine (mean difference, *p*-value): 0.6, <0.05.
Income	Yazdany *et al*. (2007)	Patients with higher income were: more likely to visit a rheumatologist (adjusted odds ratio, *p*-value): >$100,000 (reference group); $80,000 - $100,000 (0.74, 0.39); $60,000 - $80,000 (0.70, 0.26); $40,000 - $60,000 (0.92, 0.80), $0 - $40,000 (0.52, 0.03) more likely to identify any specialist as being primarily responsible for SLE care (adjusted odds ratio, *p*-value): >$100,000 (reference group); $80,000 - $100,000 (0.60, 0.18); $60,000 - $80,000 (0.78, 0.50); $40,000 - $60,000 (0.91, 0.79), $0 - $40,000 (0.47, 0.03).
	Krishnan *et al*. (2006)	were associated with higher hospital charges (beta coefficient, p-values): <$25,000 (reference group); $25,000-$29,999 (-103, <0.05); $30,000 - $34,999 (376, <0.05); ≥$35,000 (1087, <0.05).
Socioeconomic status score (SES)	Ward *et al*. (2008)	Patients in the lowest quartile of socioeconomic status scores (SES) were associated with more avoidable hospitalisations (adjusted odds ratio, *p*-value): highest quartile (reference group); lowest quartile (1.16, 0.02).
General Health Indicators		
Physical functioning	Panopalis *et al*. (2008)	Patients with poorer physical functioning were: associated with higher direct costs (adjusted coefficient per 1 point increase in SF-12 PCS scores, *p*-value): -0.019, 0.000.

Factors	Studies (Author, year)	Major conclusions
	Huscher *et al*. (2006)	associated with higher direct costs (adjusted coefficient per unit of worsening in FFbH scores, p-value): 34, <0.05.
	Sutcliffe *et al*. (2000)	associated with higher direct costs (adjusted coefficient (£) per 1 point increase in SF-36 PCS scores, p-value): -38.0, <0.05.
	Waters *et al*. (1996)	associated with more visits to a physician (adjusted coefficient per 1 point increase in SF-36 PCS scores, p-value): -0.05, <0.01.
	Waters *et al*. (1996)	more likely to be hospitalised (adjusted odds ratio, p-value): -1.021,<0.05.
	Lacaille *et al*. (1994)	associated with higher direct costs (adjusted coefficient (CAD$) per 1 point increase in AIMS physical function scores, p-value): 3676, 0.0001.
Co-Morbid Conditions	Krishnan *et al*. (2006)	Patients with a greater number of medical conditions were associated with: higher hospitalisation charges (beta coefficient, p-value): 136, <0.05.
	Edwards*et al*. (2003)	Patients with more co-morbid conditions were associated with a longer hospital stay (p-value): <0.05.
Mental health status / Psychological functioning	Panopalis *et al*. (2008)	Patients with poor mental functioning were associated with higher direct costs (adjusted coefficient per 1 point increase in SF-12 MCS scores, p-value): -0.039, 0.000.
	Moore *et al*. (2000)	Patients with a poorer SF-36 "Vitality" subscale score were more likely to use alternative medicine (mean difference, p-value): -3.86, <0.05.
Laboratory Indices		
Serum Creatinine	Clarke *et al*. (1993)	Patients with higher serum creatinine levels were associated with higher direct costs (adjusted coefficient (CAD$), p-value):34.89, 0.0001.
	Petri *et al*. (1992)	more likely to be hospitalised for infections (adjusted odds ratio; p-value): 1.57, 0.03.
WBC	Petri *et al*. (1992)	Patients with higher WBC counts were more likely to be hospitalised for active SLE (adjusted odds ratio; p-value): 1.26, 0.01.
ESR	Petri *et al*. (1992)	Patients with higher ESR levels were more likely to be hospitalised for infections (adjusted odds ratio; p-value): 1.03, 0.002.
C3	Petri *et al*. (1992)	Patients with lower C3 levels were more likely to be hospitalised for infections (adjusted odds ratio; p-value): 0.98, 0.06.
SLE-Disease Specific Indicators		
SLE severity	Yazdany *et al*. (2007)	Patients with more severe SLE were more likely to visit rheumatologists (adjusted odds ratio; p-value): 1.43, 0.05.
	Sutcliffe *et al*. (2001)	associated with higher direct costs (adjusted coefficient (£) per 1 point increase in SLICC scores, p-value): 875.7, <0.05.
	Rojas-Serrano *et al*. (2000)	more likely to be hospitalised upon presentation to the emergency room (p-value): 0.0001.
	Lacaille *et al*. (1994)	associated with higher direct costs (adjusted coefficient (CAD$) per 1 point increase in global severity index scores, p-value): 2710, 0.004.
SLE activity	Panopalis *et al*. (2008)	Patients with more active SLE were associated with higher direct costs (adjusted coefficient per point increase in SLAQ score) , p-value): 0.019, 0.007.
	Huscher *et al*. (2006)	associated with higher direct costs (adjusted coefficient, p-value): 506, <0.05.
	Sutcliffe *et al*. (2001)	associated with higher direct costs (adjusted coefficient (£) per 1 point increase in SLAM scores, p-value): 239.4, <0.05.
	Petri *et al*.(1992)	more likely to be hospitalised for active SLE (adjusted odds ratio; p-value): 3.25, 0.04 and infections (adjusted odds ratio; p-value): 2.81, 0.07.
SLE disease duration	Moore *et al*. (2000)	Patients with longer disease durations were less likely to use alternative medicine (mean difference, p-value): -1.1, <0.05.
	Lacaille *et al*. (1994)	associated with lower annual direct costs (adjusted coefficient (CAD$) per year, p-value): -310, 0.04.
Number of ACR criteria	Rojas-Serrano *et al*. (2000)	Patients who fulfilled less ACR criteria were more likely to be hospitalised upon presentation to the emergency room (p-value): 0.005.
	Edwards *et al*.(2003)	less likely to be readmitted to a hospital within a 12-month period (hazard ratios per extra criteria, p-value): 1.34, 0.01.
Age of diagnosis	Leong *et al*. (2003)	Patients with an earlier age of diagnosis were more likely to use alternative medicine to treat SLE (adjusted odds ratio, p-value): 0.96; <0.10.
Perception of SLE disease severity	Leong *et al*. (2003)	Patients who perceived their disease to be milder were more likely to use alternative medicine (adjusted odds ratio, p-value): mild (reference group); moderate (0.27, <0.10); severe (0.55, <0.10).
Presence of nephritis	Carls *et al*. (2009)	Patients with nephritis incurred almost four times higher medical expenditures than patients without nephritis.
Presence of renal damage	Clarke *et al*. (2008)	Patients with renal damage incurred higher direct costs (adjusted percentage change in direct cost (per unit damage of the SLICC/ACR DI renal subscale), p-value): 24% , <0.05.

Factors	Studies (Author, year)	Major conclusions
Attitudes / Behavioural / Social Factors		
Attitude towards disease	Leong *et al*. (2000)	Patients with negative attitudes were more likely to use alternative medicine to treat SLE (adjusted odds ratio, p-value): 1.15; <0.10.
	Waters *et al*. (1996)	Associated with more visits to physicians (adjusted coefficient (RAI scores), p-value: -0.16, <0.05.
Social support	Clarke *et al*. (1993)	Patients with poorer social support were associated with higher direct costs (adjusted coefficient (CAD$) per unit increase in ISEL scores, p-value): -11.35, 0.0178.
Patient satisfaction with medical care	Moore *et al*. (2000)	Patients who were less satisfied with medical care were more likely to use alternative medicine (mean difference in PSQ general satisfaction scores, p-value): -2.95, <0.05.
Medication adherence	Julian *et al*. (2009)	Patients who had medication adherence difficulties due to medication forgetfulness were more likely to visit the emergency room (adjusted odds ratio, p-value): 1.45, 0.03
Other Factors		
Hospital volume	Ward *et al*. (2008)	SLE patients admitted to hospitals with high hospital volumes were associated with more avoidable hospitalisations (adjusted odds ratio, p-value): low-volume hospital (reference group); high-volume hospital (0.82, 0.0002).
Healthcare provider (rheumatologists *vs*. primary care physicians)	Molina *et al*. (2008)	Rheumatologists who followed SLE patients ordered more ESR (p<0.5), anti-dsDNA antibodies (p<0.5) and serum complement (p<0.1) laboratory tests prescribed hydroxychloroquine (p<0.01) more frequently than primary care physicians who followed SLE patients.
Country of healthcare delivery	Gironimi *et al*. (1996)	Canadian SLE patients were associated with higher medication costs as compared to American SLE patients (p-value): 0.01.
US state of healthcare delivery	Katz *et al*. (1998)	SLE patients in Virginia were more likely to be referred to rheumatologists as compared to SLE patients in Colorado or Massachusetts (adjusted odds ratio, p-value): 1.35, 0.0001.

African-American female (0.53; 0.35 to 0.80). Another study (28) reported that Hispanics with lengthier periods of care incurred lower costs (adjusted patient-month cost (US$) per unit length of care; p-value): -37.7265; <0.0001. With regards to the association of gender with health services utilisation, females were found to have higher utilisation of specialty care in one study: male *vs*. female (adjusted odds ratio; 95%CI): 2.61; 1.55 to 4.39 (17), but lower hospital charges (US$) in another study: male *vs*. female (beta coefficient; 95%CI): -235; -399 to -739 (34). Only one (21) out of five studies (20, 21, 24, 29, 39) found that patients who were married incurred lower direct costs (Canadian $): non-married *vs*. married (adjusted coefficient ($); p-value): -274.46, 0.0587.

Socioeconomic factors

The type of health insurance plan of subjects was found to be associated with health services utilisation in five (16, 18, 31, 34, 37) out of seven studies (16-18, 31, 34, 35, 37). In the eight studies evaluating the association of education with utilisation (17, 20, 24, 27, 29, 35, 36, 39), subjects with lower education were found to be associated with lower utilisation in two studies (24, 29). Lower income was also found to be associated with lower utilisation in two (17, 34) out of four studies (17, 23, 34, 36).

General health indicators

Among SLE patients, poorer physical functioning was associated with higher utilisation in all six studies that evaluated the association of health status with utilisation (20, 21, 24, 27, 29, 31). In the two studies that evaluated the presence of co-morbid conditions (33, 34), this factor was found to be associated with higher consumption of hospital services. Mental health status or psychological functioning, as assessed by the SF-12, SF-36 and AIMS, were not found to be significant except in two studies (20, 24). Panopalis *et al*. found that patients with poorer mental functioning were associated with higher direct costs (adjusted coefficient; p-value): -0.039, 0.000 (20). In another study, a poorer score on the "Vitality" sub-scale was associated with alternative medicine utilisation: non-users *vs*. users (mean difference; 95%CI): -3.86; -7.42 to -0.30 (24).

Laboratory indices

Laboratory indices were evaluated in two studies (21, 35), of which higher serum creatinine was the only index associated with increased utilisation in both studies.

SLE-disease specific indicators

Subjects with greater SLE severity were associated with higher utilisation in four (17, 22, 29, 36) of six studies that evaluated disease severity (17, 22, 24, 29, 33, 36). In the eight studies (17, 20, 22, 24, 27, 29, 35, 36) that evaluated SLE activity, greater disease activity was associated with higher utilisation in four studies (20, 27, 29, 35). In a study investigating the economic consequences of nephritis in SLE patients, Carls *et al*. reported that patients with nephritis incurred almost four times higher medical expenditures than patients without nephritis (30). SLE patients with renal damage were also found to incur higher direct costs in the Tri-National Study (21). Conflicting results were reported with regards to the association of disease duration with investigation in five studies (21, 24, 27, 29, 35). Patients with both longer (20) and shorter (21, 24) disease durations were found to be associated with higher utilisation in separate studies.

Two studies evaluated the number of ACR criteria present with conflicting results. In a study conducted by Edwards *et al*., subjects with more ACR criteria were associated with higher hospital readmissions within 12 months: hazard ratio per extra criteria fulfilled; p-value: (1.34; p<0.01) (33).

However, Rojas-Serrano *et al.* found that the presence of more ACR criteria was associated with fewer hospitalisations upon presentation to the emergency room (*p*=0.001) (36). Other SLE-related factors associated with utilisation were the age of diagnosis and perception of disease severity as reported by Leong *et al.* (39). In this study, SLE patients with an earlier age of diagnosis ((adjusted odds ratio per year of age; 90% CI): 0.95; 0.92 to 0.98), and a perception of milder disease ((mild as reference (adjusted odds ratio; 90% CI): moderate (0.27; 0.14 to 0.54) and severe (0.55; 0.16 to 1.94)) were more likely to use alternative medical therapies for the treatment of SLE (39).

Attitudes/behavioural/social factors

Attitude toward disease and treatment, as assessed by the Rheumatology Attitudes Index (RAI), was associated with utilisation in both studies that evaluated this factor (31, 39). One of three studies evaluating social support found that subjects with higher levels of social support incurred lower direct costs ((adjusted coefficient (Canadian $); SE): patients with direct costs <4,250 (-11.35; 4.73) and patients with direct costs ≥4,250 (-399.81; 140.86)) (21). Of the two studies that evaluated patient satisfaction with medical care (24, 29), Moore *et al.* reported that patients who were more dissatisfied were more likely to be users of alternative medicine: non-users *vs.* users (mean difference; 95%CI): -2.95; -5.57 to -0.32 (24). In one study investigating the effect of medication adherence on services utilisation, Julian *et al.*, reported that patients reporting adherence difficulties due to medication forgetfulness were more likely to visit the emergency room (adjusted odds ratio; 95%CI): 1.45; 1.04–2.04 (19). However, no association was found between medication adherence and physician visits or hospitalisations.

Other factors

In one study comparing health services utilisation among SLE patients from the US, UK and Canada, Clarke *et al.* reported no difference in total utilisation or costs incurred by SLE patients of these countries (23). In another study, Gironimi *et al.* found that healthcare costs incurred by American SLE patients exceeded those of Canadian SLE patients by two-fold ((mean healthcare costs (US$); SEM): Stanford (10,530; 995) *vs.* Montreal (5,271; 691)). However, after reassigning Canadian prices to American health services in multivariate analysis, Canadian SLE patients were found to have similar numbers of diagnosis procedures and physician visits, but incurred higher medication costs than American SLE patients (*p*=0.01) (26). One study evaluated the difference in utilisation according to residence in one of three US states and found that residents of Virginia were more likely to receive rheumatology specialty care (adjusted odds ratio; 95%CI (white male from Massachusetts as reference): Virginia (2.02; 1.65 to 2.49) and Colorado (0.86; 0.66 to 1.11)) (38). In a study comparing utilisation between SLE patients followed by primary care physicians and rheumatologists, it was found that rheumatologists ordered more laboratory tests for SLE biomarkers and prescribed hydroxychloroquine more frequently than did primary care physicians. However, there was no difference in office visits, emergency room visits or hospitalisations between these groups of patients (32).

Discussion

A wide range of factors affecting healthcare utilisation was evaluated collectively by the 25 studies reviewed. Of these, the type of health insurance plan, physical functioning and SLE disease severity and were found to be associated with healthcare utilisation in the majority of studies that evaluated them. Based on the Andersen model, equitable access has been defined to occur when demographic and need variables, rather than social structure and enabling resources, account for most of the variance in utilisation (14). Health insurance is an enabling resource and this suggests that there may not be equitable healthcare access among SLE patients. Given that all seven studies investigating the effect of health insurance on health services utilisation were conducted in the US, these findings may not be generalised to other countries with a different health care financing system.

Our findings were also in contrast to the Andersen model in that demographic factors were, in general, not predictive of utilisation. One systematic review evaluating utilisation in chronic illness made a similar finding, in which only 7 of 32 studies found that older patients made more physician visits (41). In our review, however, younger SLE patients were found to have higher utilisation in six of 13 studies. A possible explanation is the reduction in disease activity as patient age, particularly after menopause (29). However, in two studies, this association persisted despite being adjusted for disease status (28, 29). Another possible explanation is that elderly SLE patients face barriers to accessing care. For example, in a study among elderly Medicare patients, the doctors' lack of responsiveness to patient concerns, size of medical bills, transportation and street safety were identified as barriers to health care access (42). Thus, further studies are required to better understand why younger SLE patients were likely to consume greater healthcare resources. A further possible reason is that the studies may not have involved an inception cohort of SLE patients, in which case patients with more severe and milder disease may have been under-represented because of mortality and loss to follow up respectively.

Among the socioeconomic factors, the type of health insurance plan was most often found to be associated with utilisation. However, as the studies reviewed were conducted in the United States, readers should note that this is a context-specific factor and that results may not be generalised outside the United States. Modifying the choice or coverage of health insurance plans of SLE patients is a potential option in efforts to improve equitable utilisation, particularly for outpatient visits. Socioeconomic factors, rather than ethnicity, have been found to account for different mortality rates among ethnic groups (6, 9). In our review, it was also interesting to note that ethnicity alone was not significantly associated with health services utilisation in any of the twelve studies investigating its effect.

That higher utilisation of health services was associated with greater disease severity reflects the need for management of complications arising from irreversible organ damage accrued over the disease course. However, it was somewhat unexpected that disease activity was associated with utilisation in only half the studies. One possible suggestion is that patients experiencing flares may not be receiving timely care. Interestingly, self-reported physical functioning (43) was more consistently associated with healthcare utilisation than physician-assessed SLE activity. This provides further support for the need to incorporate patients' perspectives in their disease management. In one study, Strand *et al.* reported that as disease activity decreased, physical functioning as measured by SF-36 improved (44). Hence, it is likely that disease activity and severity exert their effects on utilisation through the deteriorating health status of patients (44). In addition to its effect on healthcare utilisation, poorer physical functioning in SLE patients has also been associated with higher indirect costs (21, 24, 27, 29). Hence, disease activity, severity or physical functioning scores may guide clinical management (13) and predict costs incurred by SLE patients.

Through this review, we have also identified several possible issues with some studies which also suggest areas for future research. First, we found that the majority of the studies reviewed were cross-sectional or retrospective in nature. As disease activity changes with time, more prospective longitudinal studies are needed to ensure that the disease activity recorded precedes the usage of health services being measured. Furthermore, cross-sectional studies show association but not causation and are less likely to study an inception cohort of patients, which may result in under or overestimation of health services utilisation if patients with more severe or very mild disease are excluded (due to mortality or selection bias, respectively). Second, the reliability of self-reported utilisation without cross-validation with databases in several studies reviewed (16-20, 24, 25, 29, 33, 39, 40) posed a concern and highlighted the need for this to be incorporated in future studies. Self-reported utilisation has been found to be reliable in the adult population (>18years) (45), but unreliable among the older adult population (>65 years) (46).Third, the existing gap in current literature due to the small number of studies available highlights the need for more future research to be conducted in this area.

The strength of this review lies in the rigorous systematic approach we undertook to identify and shortlist relevant studies for this review. The search involved multiple electronic databases and hand searches of retrieved articles. Each abstract and full text were reviewed twice by independent reviewers based on explicit inclusion and exclusion criteria.

However, this review is not without its limitations. One limitation of this review is that a variety of methodologies was employed in included studies to study a variety of factors. This greatly limits our ability to generalise across studies. Furthermore, due to the broad definition of "health services" adopted in this review, we included studies with a spectrum of utilisation measures. Data on the actual units of healthcare consumption, which would have allowed us to make better comparisons across studies, was also not available in place of costs or charges incurred. As a result of this heterogeneity, quantitative synthesis via a meta-analysis was not feasible. Within studies using the same measure of utilisation, we have described trends of factors found to be significant. However, the small number of studies did not allow us to draw conclusions about specific questions regarding each type or measure of service utilisation. Another limitation was that a majority of studies recruited patients from purely clinical sources, or used claims and short-term hospital databases and thus limits the way this review can be generalised. SLE patients who lack access to care would be seriously underrepresented. Nevertheless, we acknowledge that including such patients in research of this nature is challenging and thus the data from the studies reviewed may be seen as presenting the best available information on this topic. Finally, an inherent limitation in a systematic review including studies from several countries is that the results cannot be generalised from one country to another. Nonetheless, the information will be useful as a primer for identifying potential factors associated with the utilisation of different types of health services within any country.

Conclusions

In this systematic literature review involving 25 studies, we found that the type of health insurance plan, poorer physical functioning and greater SLE disease severity were significantly associated with greater healthcare utilisation. Based on the Andersen model, equitable healthcare access among SLE patients could be lacking. Better management of patient reported outcomes such as physical functioning may reduce health services utilisation in the long-term, hence the important of assessing patient reported outcomes. Timely management of SLE to reduce disease severity may also reduce health services utilisation in the long term. There is certainly a need for more well designed prospective longitudinal studies to better elucidate the causal relationships between these factors and healthcare utilisation among SLE patients, and that standardisation of study methodologies are strongly encouraged.

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