UTILIZATION OF HEALTH SERVICES AND PRESCRIPTION PATTERNS AMONG LUPUS PATIENTS FOLLOWED BY PRIMARY CARE PHYSICIANS AND RHEUMATOLOGISTS IN PUERTO RICO

María J. Molina, MD; Angel M. Mayor, MD, MS; Alejandro E. Franco, MD; Carlos A. Morell, MS; Miguel A. López, BS; Luis M. Vilá, MD

Objective: To examine the utilization of health services and prescription patterns among patients with systemic lupus erythematosus (SLE) followed by primary care physicians and rheumatologists in Puerto Rico.

Methods: The insurance claims submitted by physicians to a health insurance company of Puerto Rico in 2003 were examined. The diagnosis of lupus was determined by using the International Classification of Diseases, Ninth Revision, code for SLE (710.0). Of 552,733 insured people, 665 SLE patients were seen by rheumatologists, and 92 were followed by primary care physicians. Demographic features, selected co-morbidities, healthcare utilization parameters, and prescription patterns were examined. Fisher exact test, χ^2 test, and analysis of variances were used to evaluate differences between the study groups.

Results: SLE patients followed by rheumatologists had osteopenia/osteoporosis diagnosed more frequently than did patients followed by primary care physicians. The frequency of high blood pressure, diabetes mellitus, hypercholesterolemia, coronary artery disease, and renal disease was similar for both groups. Rheumatologists were more likely to order erythrocyte sedimentation rate, anti-dsDNA antibodies, and serum complements. No differences were observed for office or emergency room visits, hospitalizations, and utilization of routine laboratory tests. Rheumatologists prescribed hydroxychloroquine more frequently than did primary care physicians. The use of nonsteroidal anti-inflammatory drugs, cyclooxygenase-2 inhibitors, glucocorticoids, azathioprine, cyclophosphamide, and methotrexate was similar for both groups.

Conclusion: Overall, the utilization of health services and prescription patterns among SLE patients followed by primary care physicians and rheumatologists in Puerto Rico are similar. However, rheumatologists ordered SLE biomarkers of disease activity and prescribed hydroxychloroquine more frequently than did primary care physicians. (*Ethn Dis*. 2008;18[Suppl 2]:S2-205–S2-210)

Key Words: Systemic Lupus Erythematosus, Healthcare Utilization, Prescription Pattern, Puerto Rico

INTRODUCTION

Systemic lupus erythematosus (SLE) is an autoimmune disease characterized by a wide range of clinical and immunologic manifestations.[1] Genetic, socioeconomic and environmental factors influence the course and outcome of lupus.[2,3] Because of the complexity of this disease, healthcare to SLE patients should be provided primarily by rheumatologists with a multidisciplinary team, which includes primary care physicians and other subspecialists.[4]

An early referral of patients with rheumatic disorders to rheumatologists may assist to establish a prompt diagnosis and therapy. Frequently, disagreement occurs between primary care physicians and rheumatologists when diagnosing rheumatic diseases.[5] For example, Gamez-Nava et al found that 41% of diagnoses made by primary care physicians were subsequently modified by rheumatologists.[5] These investigators also showed a low concurrence for the diagnosis of SLE. The differences of healthcare provided by primary care physicians and rheumatologists to SLE patients are not well known. Therefore, we examined the utilization of health services and prescription patterns among SLE patients followed by these groups of physicians by using a large database from a health insurance company in Puerto Rico.

From the Department of Medicine, Division of Rheumatology, University of Puerto Rico Medical Sciences Campus (MJM, AMM, LMV); Triple-S, Inc. (Independent license of BC/BSA) (AEF, CAM, MAL), San Juan, Puerto Rico.

Address correspondence and reprint requests to: Luis M. Vilá, MD; Chief and Program Director; Division of Rheumatology; University of Puerto Rico, Medical Sciences Campus; PO Box 365067; San Juan, PR 00936-5067; 787-758-2525 x. 1825; 787-764-6839 (fax); lvila@rcm.upr.edu

METHODS

Study Population

In 2003, 552,733 people from the island of Puerto Rico had private healthcare insurance (corporate or individual) with Triple-S, Inc. (independent license of BC/BSA). Of the insurance claims submitted by physicians during that year, 877 participants had a diagnosis of SLE (code 710.0) per the International Classification of Diseases, Ninth Revision (ICD-9). Among SLE patients, 665 were seen by rheumatologists, 92 by primary care physicians (general practitioners, family physicians, pediatricians, and internists), and 120 by both rheumatologists and primary care physicians. For this study, we excluded patients who were simultaneously followed by both groups of physicians since we could not determine which specific type of provider ordered laboratory tests and drug prescriptions.

Triple-S, Inc. provides access to >10,000 physicians and other healthcare providers throughout the island. In 2003, 67 rheumatologists and 3209 primary care physicians participated in the providers' network.

Variables

The Triple-S database contains information provided in insurance claims

submitted by physicians, dentists, laboratories, pharmacies, and hospitals. The healthcare providers and locations of services were categorized. Claims that contained complete data were processed by the health insurance company. Claims with incomplete information were not included in the database. The following variables were examined for this study: demographic parameters (age and sex), selected co-morbidities, healthcare utilization, and prescription patterns.

The assessment of the following co-morbidities was done by using ICD-9 codes only: nephrotic syndrome, renal insufficiency, cerebral vascular accident, coronary artery disease (myocardial infarction and angina pectoris), and avascular necrosis. The diagnosis of the following conditions was made by using ICD-9 codes and/or Current Procedural Terminology, 4th Edition (CPT-4) codes: end-stage renal disease (diagnosis or patients receiving hemodialysis or peritoneal dialysis or renal transplant) and cataracts (diagnosis or cataract surgery). The assessment of the following disorders was done by using the ICD-9 codes or disease-specific pharmacologic treatment by using the Medi-Span Therapeutic Classification System: hypothyroidism, hyperthyroidism, high blood pressure, diabetes mellitus, hypercholesterolemia, and osteopenia/osteoporosis. The specific ICD-9, CPT-4, and Medi-Span codes used for the ascertainment of selected co-morbidities are shown in Appendix 1.

The utilization of health services included the number of office visits to primary care physicians or rheumatologists, visits to the emergency room, hospitalizations and laboratory utilization. The laboratory tests were determined according to the CPT-4 codes. Complete blood count (85007, 85008, 85014, 85018, 85031, or 85048) included erythrocyte count, leukocyte count, hemoglobin, and hematocrit. Basic metabolic panel (80048) included serum calcium, carbon dioxide, chloride, creatinine, urea nitrogen, glucose, potassium, and sodium. Comprehensive metabolic panel (80053) contained serum albumin, bilirubin, calcium, carbon dioxide (bicarbonate), chloride, creatinine, glucose, alkaline phosphatase, potassium, total protein, sodium, alanine aminotransferase (ALT), aspartate aminotransferase (AST), and blood urea nitrogen (BUN). We also examined erythrocyte sedimentation rate (ESR) (85651), urinalysis (81000, 81002, 81003, or 81005), creatinine clearance (82575), C-reactive protein (86140), serum complements (complement antigen [86160], complement activity [86161], or CH50 [86162]), anti-dsDNA antibodies (86225), and anticardiolipin antibodies (86147).

The prescription pattern of the following drugs was examined by using the Medi-Span Therapeutic Classification System: nonsteroidal anti-inflammatory drugs (NSAIDs), cyclooxygenase-2 (COX-2) inhibitors, glucocorticoids, hydroxychloroquine, azathioprine, cyclophosphamide, methotrexate, mycophenolate mofetil, dapsone, danazol, and cyclosporine.

Statistical Analysis

The Statistical Package of Social Sciences (SPSS Inc., Chicago, Ill) program was used to perform univariable and bivariable analyses. Univariable analyses were used to determine the frequencies of clinical conditions, healthcare utilization parameters, and drug regimens among SLE patients. Differences between SLE patients followed by primary care physicians and rheumatologists were analyzed with the χ^2 and Fisher exact tests. Analysis of variance (ANOVA) was used to evaluate mean differences between study groups. Values were considered significant at $P<.05$.

RESULTS

Table 1 shows the demographic features and selected co-morbidities of SLE patients followed by primary care physicians and rheumatologists in 2003. The demographic parameters and co-morbidities were similar except for osteopenia/osteoporosis, which was more common in patients seen by rheumatologists (23.8% vs 14.1%, $P<.05$). No statistically significant differences were found for renal insufficiency, nephrotic syndrome, end-stage renal disease, cerebrovascular accidents, hypothyroidism, hyperthyroidism, high blood pressure, diabetes mellitus, hypercholesterolemia, coronary artery disease, cataracts, and avascular necrosis.

No significant differences were found for mean number of office visits (1.5 ± 1.5 vs 3.0 ± 2.8), emergency room visits (0 vs 0.1 ± 0.7), and hospitalizations (0 vs 0.2 ± 0.2) between patients followed by primary care physicians and rheumatologists (data not shown).

Table 2 depicts the profile of laboratory tests ordered by primary care physicians and rheumatologists. Rheumatologists were more likely to order ESR (72.3% vs 59.8%, $P<.05$), anti-dsDNA antibodies (32.3% vs 20.7%, $P<.05$) and serum complement (45.9% vs 30.4%, $P<.01$) than were primary care physicians. No differences were found for complete blood count, basic metabolic panel, comprehensive metabolic panel, urinalysis, creatinine clearance, C-reactive protein, and anticardiolipin antibodies. When the mean number of laboratory tests were evaluated, rheumatologists more frequently ordered comprehensive metabolic panels (2.1 ± 2.0 vs 1.5 ± 1.6, $P<.01$), ESR (1.9 ± 2.1 vs 1.1 ± 1.2, $P<.01$), and anti-dsDNA antibodies (0.7 ± 1.4 vs 0.3 ± 0.8, $P<.05$). No significant differences were found for complete blood count, basic metabolic panel, urinalysis, creatinine clearance, C-reactive protein, serum complement, and anticardiolipin antibodies.

Table 3 shows the prescription patterns for SLE patients. Overall, the prescription pattern of antirheumatic drugs was similar for both groups.

Table 1. Demographic features and selected co-morbidities of SLE patients followed by primary care physicians and rheumatologists, Puerto Rico, 2003

Features	Primary care physicians (*n*=92)	Rheumatologists (*n*=665)
Age, mean years (SD)	39.5 (15.0)	42.7 (12.7)
Sex, % women	94.6	92.6
Renal insufficiency, %	0	1.5
Nephrotic syndrome, %	0	.5
End-stage renal disease, %	1.1	2.1
Seizures, %	8.7	6.6
Cerebral vascular accident, %	2.2	1.4
Hypothyroidism, %	18.5	19.1
Hyperthyroidism, %	0	.5
High blood pressure, %	32.6	33.2
Diabetes mellitus, %	12.0	11.7
Hypercholesterolemia, %	13.0	11.6
Coronary artery disease, %	7.6	4.9
Cataracts, %	0	.6
Osteopenia/osteoporosis, %	14.1	23.8*
Avascular necrosis, %	0	.2

SLE = systemic lupus erythematosus, SD = standard deviation.
* $P<.05$

NSAIDs, followed by glucocorticoids and hydroxychloroquine, were the most frequently prescribed medications by both groups of physicians. However, hydroxychloroquine was prescribed more frequently by rheumatologists than by primary care physicians (32.6% and 18.5%, $P<.01$). The use of NSAIDs, COX-2 inhibitors, glucocorticoids, azathioprine, cyclophosphamide, methotrexate, mycophenolate mofetil, dapsone, and danazol was comparable for both groups.

Table 2. Profile of laboratory tests ordered by primary care physicians and rheumatologists for SLE patients, Puerto Rico, 2003

Laboratory tests	Primary care physicians (*n*=92)	Rheumatologists (*n*=665)
Tests ordered at any time, %		
Complete blood count	87.0	86.8
Basic metabolic panel	8.7	12.9
Comprehensive metabolic panel	76.1	79.9
Urinalysis	79.3	81.7
Creatinine clearance	15.2	20.5
Erythrocyte sedimentation rate	59.8	72.3*
C-reactive protein	12.0	17.0
Anti-dsDNA antibodies	20.7	32.3*
Serum complement	30.4	45.9†
Anticardiolipin antibodies	14.1	12.6
Average number of tests ordered, mean (SD)		
Complete blood count	2.9 (4.6)	2.9 (3.3)
Basic metabolic panel	.1 (.5)	.2 (.6)
Comprehensive metabolic panel	1.5 (1.6)	2.1 (2.0)†
Urinalysis	2.0 (1.9)	2.3 (2.1)
Creatinine clearance	.2 (.6)	.3 (.7)
Erythrocyte sedimentation rate	1.1 (1.2)	1.9 (2.1)†
C-reactive protein	.2 (.5)	.3 (.7)
Anti-dsDNA antibodies	.3 (.8)	.7 (1.4)*
Serum complement	.2 (.2)	.1 (1.1)
Anticardiolipin antibodies	.1 (.3)	.1 (.4)

SLE = systemic lupus erythematosus, SD = standard deviation.
* $P<.05$.
† $P<.01$.

DISCUSSION

In general, we found that the utilization of health services and prescription patterns among SLE patients followed by primary care physicians and rheumatologists in Puerto Rico were similar. The only differences found were that rheumatologists ordered SLE biomarkers of disease activity and prescribed hydroxychloroquine more frequently than did primary care physicians. Office and emergency room visits, hospitalizations, use of routine laboratory tests, and prescriptions for SLE drugs except for hydroxychloroquine were comparable for both groups.

The American College of Rheumatology Ad Hoc Committee on SLE guidelines recommends that primary care physicians should refer SLE patients to rheumatologists to establish SLE diagnosis; assess disease activity and severity; establish general management; and manage uncontrolled disease, major organ damage, and complications of therapy.[4] Other study suggests that even patients with mild disease should have at least concurrent care with rheumatologists, since most of these patients will eventually require rheumatologic interventions.[6] These guidelines seem to be followed in Puerto Rico. Seventy-six percent of the 877 SLE patients were followed exclusively by rheumatologists, 14% of patients were followed by both rheumatologists and primary care physicians, and only 10% were seen only by primary care physicians. These data suggest that rheumatologists are the main healthcare providers for SLE patients in Puerto Rico.

We observed that osteopenia/osteoporosis was diagnosed more commonly

Table 3. Prescription patterns for SLE patients followed by primary care physicians and rheumatologists, Puerto Rico, 2003

Drugs	Primary care physicians (*n*=92) %	Rheumatologists (*n*=665) %
NSAIDs	100.0	99.4
COX-2 inhibitors	43.5	36.5
Glucocorticoids	45.7	51.6
Hydroxychloroquine	18.5	32.6*
Azathioprine	3.3	8.0
Cyclophosphamide	0	1.1
Methotrexate	4.3	5.9
Mycophenolate mofetil	0	1.1
Dapsone	0	.3
Danazol	0	.9
Cyclosporine	0	0

SLE = systemic lupus erythematosus, NSAID = nonsteroidal anti-inflammatory drug, COX-2 = cyclooxygenase-2.
* $P<.01$.

in lupus patients followed by rheumatologists than by primary care physicians. The most likely explanation for this observation is that rheumatologists ordered bone mineral density measurements more frequently for screening and preventing glucocorticoid-induced osteoporosis. This possibility is in agreement with the findings of Curtis et al, who found that patients seen by rheumatologists had higher rates of bone density measurements and treatment for osteoporosis than did patients followed by family physicians.[7] Unfortunately, we did not examine bone density measurements in our population. It is unlikely, however, that the differences observed here in osteopenia/osteoporosis could be related to glucocorticoid treatment because the use of this drug was similar for both groups.

ESR, anti-dsDNA antibodies, and serum complements were ordered more frequently by rheumatologists than by primary care physicians. ESR elevation and elevated anti-dsDNA antibodies are strongly associated with disease activity and damage accrual in SLE and therefore should be used to monitor lupus patients.[8] Few studies have examined the use of laboratory tests in the clinical practice of rheumatologists.[9] In contrast to our study, Donald and Ward found that most (92%) rheumatologists in the United States use anti-dsDNA antibodies and C3 levels, but not ESR, to monitor SLE patients.[9] In our study, rheumatologists more frequently ordered ESR (72%) than anti-dsDNA (32%) antibodies and serum complements (46%).

We observed that rheumatologists more frequently prescribed hydroxychloroquine than did primary care physicians. Likewise, Zink et al found that rheumatologists prescribed antimalarials in 36.5% of SLE patients versus the 17.0% by nonrheumatologists.[10] However, in comparison to other studies, rheumatologists in Puerto Rico prescribe hydroxychloroquine relatively less frequently.[10–13] The utilization rates of hydroxychloroquine in lupus patients range from 36% to 67%.[10–14] Generally, hydroxychloroquine is usually used for lupus patients with mild disease.[15,16] In addition, this antimalarial drug has several other clinical benefits for lupus patients.[11–13,16–19] Hydroxychloroquine decreases major disease flares, reduces the risk of damage accrual, decreases serum cholesterol levels, decreases the risk of thrombotic events, protects against osteoporosis in patients treated with glucorticoids, and reduces mean glucose levels in patients with lupus.[11–13,16–19] Therefore, hydroxychloroquine is recommended for all lupus patients, regardless of disease activity or severity.

The present study has some limitations. First, the diagnosis of SLE was based only on the ICD-9 code, and not on American College of Rheumatology classification criteria. Second, we only included SLE patients with private health insurance but not those under the government healthcare program, most of whom are below the poverty level. Several studies have shown that lower socioeconomic level is related to higher morbidity and mortality in SLE.[2,20] Thus, it would be very important to examine healthcare utilization and use of pharmacologic agents in this population of patients. Third, since the data were collected for one particular year, we do not know if patients seen by primary care physicians were previously evaluated by rheumatologists and guidelines regarding general management and treatment were already given. Finally, we could not determine the length of time since SLE diagnosis. Variability in disease duration could account for some differences in services and drug utilization between patients followed by the two types of providers.

Despite these limitations, the results presented here have clinical implications. Also, it highlights the importance to access a large database from a health insurance company in order to identify those areas in healthcare delivery that need attention or improvement. This study suggests that primary care physicians should be more aware of ordering bone mineral density measurements, particularly for lupus patients taking glucocorticoids. Furthermore, it shows the importance for both rheumatologists and primary care physicians to consider the use of hydroxychloroquine more frequently in their lupus patients. Finally, primary care physicians are advised to use ESR and anti-dsDNA antibodies more often to monitor disease activity in SLE patients.

Implications for Improving Health Disparities

Optimal utilization of hydroxychloroquine in lupus patients could result in a better disease course and outcome as the use of this immunomodulatory agent has been associated with lower disease activity and damage accrual in SLE.[11–13,16–19] Similarly, a better use of SLE disease activity biomarkers might help to identify those patients at risk of disease flares and, hence, aid in providing prompt and effective immunosuppressive therapy.

ACKNOWLEDGMENTS

This study was supported by the National Center for Research Resources (NCRR/NIH) RCMI Clinical Research Infrastructure Initiative (RCRII) award #1P20 RR11126, NIH/RCMI Grant #G12 RR03035, and an unrestricted educational grant from Bristol-Myers Squibb Company.

REFERENCES

1. Mills JA. Systemic lupus erythematosus. *N Engl J Med*. 1994;330:1871–1879.
2. Alarcón GS, Mc Gwin G Jr, Bastian HM, et al. Systemic lupus erythematosus in three groups. VII. Predictors of early mortality in the LUMINA cohort. LUMINA study group. *Arthritis Rheum*. 2001;45:191–202.
3. Pons-Estel BA, Catoggio LJ, Cardiel MH, et al. Grupo Latinoamericano de Estudio de Lupus. The GLADEL multinacional Latin American prospective inception cohort of 1,214 patients with systemic lupus erythematosus: ethnic and disease heterogeneity among "Hispanic." *Medicine (Baltimore)*. 2004;83:1–17.
4. Gladman DD, Urowitz MB, Esdaile JM, et al. American College Rheumatology Ad Hoc Committee on SLE Guidelines. Guidelines for referral and management of systemic lupus erythematosus in adults. *Arthritis Rheum*. 1999;42:1785–1796.
5. Gamez-Nava J, Gonzalez-Lopez L, Davis P, Suarez-Almazor ME. Referral and diagnosis of common rheumatic disease by primary care physicians. *Br J Rheumatol*. 1998;37:1215–1219.
6. Urowitz MB, Kagal A, Rahman P, Gladman DD. Role of specialty care in the management of patients with systemic lupus erythematosus. *J Rheumatol*. 2002;29:1207–1210.
7. Curtis JR, Westfall AO, Allison JJ, et al. Longitudinal patterns in the prevention of osteoporosis in glucocorticoid-treated patients. *Arthritis Rheum*. 2005;52:2485–2494.
8. Vilá LM, Alarcón GS, McGwin G Jr, Bastian HM, Fessler BJ, Reveille JD, for the LUMINA Study Group. Systemic lupus erythematosus in a multiethnic cohort (LUMINA): XXIX. Elevation of erythrocyte sedimentation rate is associated with disease activity and damage accrual. *J Rheumatol*. 2005;32:2150–2155.
9. Donald F, Ward MM. Evaluative laboratory testing practices of United States rheumatologists. *Arthritis Rheum*. 1998;41:725–729.
10. Zink A, Fischer-Betz R, Thiele K, et al. for the German Collaborative Arthritis Centres. Health care and burden of illness in systemic lupus erythematosus compared to rheumatoid arthritis: results from the national database of the German Collaborative Arthritis Centres. *Lupus*. 2004;13:529–536.
11. Tam LS, Gladman DD, Hallett DC, Rahman P, Urowitz MB. Effect of antimalarial agents on the fasting lipid profile in systemic lupus erythematosus. *J Rheumatol*. 2000;27:2142–2145.
12. Fessler BJ, Alarcón GS, McGwin G Jr, et al. for the LUMINA Study Group. Systemic lupus erythematosus in three ethnic groups. XVI. Association of hydroxychloroquine use with reduced risk of damage accrual. *Arthritis Rheum*. 2005;52:1473–1480.
13. Molad Y, Gorshtein A, Wysenbeek AJ, et al. Protective effect of hydroxychloroquine in systemic lupus erythematosus. Prospective long-term study of an Israeli cohort. *Lupus*. 2002;11:356–361.
14. Cervera R, Khamashta MA, Font J, et al. Morbidity and mortality in systemic lupus erythematosus during 10-year period: a comparison of early and late manifestations in a cohort of 1,000 patients. *Medicine (Baltimore)*. 2003;82:299–308.
15. D'Cruz D. Antimalarial therapy: a panacea for mild lupus? *Lupus*. 2001;10:148–151.
16. Ho KT, Ahn CW, Alarcón GS, et al. for the LUMINA Study Group. Systemic lupus erythematosus in a multiethnic cohort (LUMINA): XXVIII. Factors predictive of thrombotic events. *Rheumatology (Oxford)*. 2005;44:1303–1307.
17. Rahman P, Gladman DD, Urowitz MB, Yuen K, Hallett D, Bruce IN. The cholesterol lowering effect of antimalarial drugs is enhanced in patients with systemic lupus erythematosus. *J Rheumatol*. 1999;26:325–330.
18. Lakshminarayanan S, Walsh S, Mohanraj M, Rothfield N. Factors associated with low bone mineral density in female patients with systemic lupus erythematosus. *J Rheumatol*. 2001;28:102–108.
19. Tsakonas E, Joseph L, Esdaile JM, et al. and The Canadian Hydroxychloroquine Study Group. A long-term study of hydroxychloroquine withdrawal on exacerbation in systemic lupus erythematosus. *Lupus*. 1998;7:80–85.
20. Bae SC, Hashimoto H, Karlson EW, Liang MH, Daltroy LH. Variable effects of social support by race, economic status and disease activity in systemic lupus erythematosus. *J Rheumatol*. 2001;28:1245–1251.

Appendix 1. Ascertainment of co-morbidities in SLE patients.

Diagnosis	ICD-9 code	CPT-4 code	Medi-Span code
Nephrotic syndrome	581.9	-	-
Renal insufficiency	593.9	-	-
End-stage renal disease or hemodialysis, peritoneal dialysis, or renal transplant	585	90935 90945 50360	-
Hypothyroidism or thyroid replacement	244.9	-	28 10 00
Hyperthyroidism or antithyroid agents	242.9	-	28 30 00
High blood pressure or antihypertensive treatment	401.0–405.99	-	36 00 00
Diabetes mellitus type II or treatment	250.00 250.02	-	27 00 00
Hypercholesterolemia or antihyperlipidemic drugs	272.0	-	39 00 00 39 40 00
Myocardial infarction	410.1–410.9	-	-
Angina pectoris	411.1 413.9	-	-
Cerebral vascular accident	436	-	-
Osteopenia/osteoporosis or biphosphonates or calcitonin	733.00–733.09 733.90	-	30 04 20 30 04 30
Cataract or cataract surgery	366.9	66830 66840 66850 66852 66920 66930 66940 66983–66986	-
Avascular necrosis	733.40–733.49	-	-

ICD-9 = International Classification of Diseases, Ninth Revision; CPT-4 = Current Procedural Terminology, 4th Edition; Medi-Span = Medi-Span Therapeutic Classification System; SLE = systemic lupus erythematosus.