

Supplemental Table 1: Data Definitions

Attribute	Classification Criteria	Definition	Notes
Acute Cutaneous Lupus	SLICC EULAR/ACR	(ICD-9: 694.5, 695.15, 695.4, 696.2, 692.72 OR ICD-10-CM: L12.0, L12.8, L41.0, L41.1, L41.8, L51.2, L56.0, L56.2, L93.0, L93.2 OR Medications: (Plaquenil (brand/trade name) OR hydroxychloroquine (generic name)): RXNORM_CUI,description: 93787,"Hydroxychloroquine Oral Tablet [Plaquenil]" 202462, "Plaquenil" 979093,"Hydroxychloroquine Sulfate 200 MG [Plaquenil]" 979094,"Plaquenil 200 MG Oral Tablet" 979094,"Hydroxychloroquine Sulfate 200 MG Oral Tablet [Plaquenil]" 979094,"Plaquenil 200 MG Oral Tablet" 1181266,"Plaquenil Oral Product" 1181267,"Plaquenil Pill" AND (ICD9: 782.1 OR ICD10: R21)) AND NOT (ICD-9: 710.3 ICD-10-CM: M33.90)	patients need to have 2 of the inclusion codes, or the listed lupus medication with either of the 2 rash ICD diagnosis codes, on ≥ 2 separate dates
Alopecia	SLICC EULAR/ACR	ICD-9: 704.00, 704.01 OR ICD-10-CM: L66.0, L66.2, L66.8, L95.9 AND NOT (ICD-9: 280.8, 280.9 ICD-10-CM: D50.8, D50.9)	
Anti-dsDNA Antibodies	SLICC EULAR/ACR	LOINC: 11013-0, 34187-5 (value >1:10) OR LOINC: 6457-6, 12277-0, 31348-6, 81716-3 (value positive or similar) OR LOINC: 42200-6, 47299-3, 32677-7, 5130-0 (value>5 IU/mL)	
Anti-Nuclear Antibodies	ACR SLICC EULAR/ACR	LOINC: 29953-7, 33253-6, 40655-3, 5048-4 (value \geq 1:80) OR LOINC: 42254-3, 47383-5, 59069-5, 8061-4 (value positive or similar) OR LOINC: 5047-6, 9423-5 (value \geq 8 IU/mL)	
Anti-Phospholipid Antibodies	SLICC EULAR/ACR	LOINC: 3181-5,3182-3,8065-5,8067-1, 43363-1,55445-1,3180-7,55443-6,8062-2,43362-3,55446-9 (value >20 G/MPL); OR LOINC: 75882-1 (value positive or similar); OR LOINC: 21108-6, 40456-6, 44448-9, 44449-7, 16135-6, 16136-4,44447-1, 56538-2, 72488-0, 1880-4 (value>20 U/ml); OR (LOINC: 20507-0, 5292-8 (value reactive or similar) AND LOINC: 5393-4 (value negative))	
Anti-Smith Antibodies	SLICC EULAR/ACR	LOINC: 17589-3, 17590-1, 9722-0 (value \geq 1:80) OR LOINC: 17591-9, 31627-3, 5355-3, 5356-1, 5357-9, 56730-5 (value positive or similar) OR LOINC: 17592-7, 43182-5,33567-9,33460-7 (value \geq 20)	
Arthritis	ACR SLICC EULAR/ACR	(ICD-9: 716.40, 716.48, 716.5*, 716.9*, 716.80, 716.88, 716.89, 719.00, 719.08, 719.49, 719.80, 719.88,719.89, V13.4, 719.6*, 719.9* OR ICD-10-CM: M12.80, M12.88, M12.89, M13.0, M25.40, M25.48, M25.50, M25.9) AND NOT (ICD-9: 715.* ICD-10-CM: M15.0, M15.9, M15.1, M15.2, M19.91, M19.019, M19.029, M19.039, M19.049, M16.10, M17.10, M19.079, M19.93, M19.219, M19.229, M19.239, M19.249, M16.7, M17.5, M19.279, M19.93, M19.90, M18.9, M16.9, M17.9, M15.8, M15.3)	Patients need to have 2 inclusion codes on ≥ 2 separate dates
Chronic Cutaneous Lupus	SLICC EULAR/ACR	ICD-9: 373.34, 729.30, 991.5, 695.4 OR ICD-10-CM: L93.0, H01.129, M79.3, T69.1XXA	patients need to have 2 of the inclusion codes on ≥ 2 separate dates
Delirium/psychosis	EULAR/ACR	(ICD-9: 345.80, 345.2, 345.10, 323.81, 355.9, 349.9, 323.82, 294.9, 323.9, 345.90, 345.81, 730.70, 289.9, 293.0, 780.39, 298.9, 345.9, 356.8, 345.50, 293.9, 345.40, 730.20 OR ICD-10-CM: G40.909, F05, G40.301, G40.901, F29, R56.9, G40.911, G40.89, F44.5) AND NOT	

		ICD-9: 042,136.9,250.60,250.62,357.2,709.1,457.1 ICD-10-CM: B20, B89, B99.9, E08.42, E09.42, E10.42, E11.40, E11.42, E13.42, I89.0, L95.9, G04.00, G04.01, G04.02, G04.2, G04.30, G04.31, G04.32, G04.39, G92 AND NOT the following if within 7 days of an inclusion code ICD-9: 959.* ICD-10: S09.8XXA, S09.90XA, S09.93XA, S19.9XXA, S29.8XXA, S39.81XA, S39.840A, S39.848A, S39.82XA, S49.80XA, S49.90XA, S59.809A, S59.819A, S59.909A, S59.919A, S69.80XA, S69.90XA, S79.819A, S79.829A, S79.919A, S79.929A, S89.80XA, S89.90XA, S99.819A, S99.919A, T07.XXXA, T14.90XA)	
Direct Coombs Test	SLICC	LOINC: 1007-4, 1006-6, 51006-5 (value positive or similar)	
Discoid Rash	ACR	ICD-9: 757.33, 695.4, 373.34, V12.29 OR ICD-10-CM: L93.0, L93.2, H01.129, Z86.2, Z86.39	Patients need to have 2 of the inclusion codes on ≥ 2 separate dates
Fever	EULAR/ACR	ICD-9: 780.60 OR ICD-10-CM: R50.9	
Hematologic Disorder	ACR	(ICD9: 289.9, 283.9, 283.0, V12.3, 288.51, 287.5, 288.59, 288.50 OR ICD-10-CM: D75.9, D59.9, D59.0, D59.1, Z86.2, D72.810, D69.6, D72.818, D72.819) OR Hemolytic Anemia Attribute (see below) OR Thrombocytopenia Attribute (see below) OR Leukopenia Attribute (see below)	
Hemolytic Anemia	SLICC EULAR/ACR	((LOINC: 718-7, 20509-6, 30350-3, 30352-9, 30351-1 (value < 8 g/dl) OR LOINC: 4544-3, 41654-5, 32354-3 (value < 28)) AND NOT the following if within 7 days of an inclusion code: ICD-9: 642.4*, 642.5*, 642.6*, 642.7* ICD-10: O14.*, O11.* OR LOINC: 31111-8, 4679-7, 17849-1, 31112-6 (value >3%)) AND LOINC: 2532-0, 14804-9, 14805-6 (value > 468 u/L)	
Immunologic Disorder	ACR	ICD9: 279.9 OR ICD-10-CM: D89.9 OR Anti-dsDNA Antibodies Attribute (see below) OR Anti-Sm Antibodies Attribute (see below)	
Leukopenia	SLICC EULAR/ACR	LOINC: 731-0, 26474-7 (value <1.5 K/uL) LOINC: 26464-8, 6690-2 (value <4 K/uL) AND NOT ICD-9: 288.03, 305.90, 572.3, 714.1 ICD-10-CM: F18.10, K76.6, M05.00, M30.*, M31.*, D70.1, D70.2	
Low Complement	SLICC	C3 (see below) OR C4 (see below)	
Low Complement C3	EULAR/ACR	LOINC: 4485-9 (value C3 <70 mg/dL) or (<80 mg/dL) depending on laboratory reference for "low normal"	To determine low C3 values, threshold should be set to be less than the documented "low normal" value provided for the test. If no low normal value is provided for the test, <70 mg/dL is suggested
Low Complement C4	EULAR/ACR	LOINC: 4498-2 (value C4 <9 mg/dL) or (<11 mg/dL) depending on laboratory reference for "low normal"	To determine low C4 values, threshold should be set to be less than the documented "low normal" value provided for the test. If no low normal value is provided for the test, < 9 mg/dL is suggested
Malar Rash	ACR	(ICD9: 782.1 OR ICD10: R21)) AND (Medications: (Plaquenil (brand/trade name) OR hydroxychloroquine (generic name)): RXNORM_CUI, description: 93787,"Hydroxychloroquine Oral Tablet [Plaquenil]" 202462,"Plaquenil" 979093,"Hydroxychloroquine Sulfate 200 MG [Plaquenil]"	ICD9 and 10 codes delineating Malar Rash were too general, so medications were added to confirm association with Lupus. Rash codes

		<p>979094,"Plaquenil 200 MG Oral Tablet" 979094,"Hydroxychloroquine Sulfate 200 MG Oral Tablet [Plaquenil]" 979094,"Plaquenil 200 MG Oral Tablet" 1181266,"Plaquenil Oral Product" 1181267,"Plaquenil Pill") AND NOT (ICD-9: 710.3 ICD-10-CM: M33.90)</p>	
Neurological Conditions	ACR	<p>(ICD9: 349.9, 294.9, 780.39, 298.9, V11.8 OR ICD-10-CM: R56.9, F29, Z86.59) AND NOT ICD-9: 042,136.9,250.60,250.62,357.2,709.1,457.1 ICD-10-CM: B20, B89, B99.9, E08.42, E09.42, E10.42, E11.40, E11.42, E13.42, I89.0, L95.9, G04.00, G04.01, G04.02, G04.2, G04.30, G04.31, G04.32, G04.39, G92 AND NOT the following if within 7 days of an inclusion code ICD-9: 959.xx ICD-10: S09.8XXA, S09.90XA, S09.93XA, S19.9XXA, S29.8XXA, S39.81XA, S39.840A, S39.848A, S39.82XA, S49.80XA, S49.90XA, S59.809A, S59.819A, S59.909A, S59.919A, S69.80XA, S69.90XA, S79.819A, S79.829A, S79.919A, S79.929A, S89.80XA, S89.90XA, S99.819A, S99.919A, T07.XXXA, T14.90XA)</p>	
Neurological Condition	SLICC	<p>(ICD-9: 053.13, 293.0, 293.9, 294.9, 298.9, 300.11, 323.81, 323.82, 323.9, 345.10, 345.40, 345.50, 345.80, 345.81, 345.9%, 349.9, 354.2, 354.5, 354.8, 355.8, 355.9, 356.4, 356.8, 356.9, 357.1, 357.6, 357.7, 357.9, 730.07, 730.18, 730.20, 730.25, 730.70, 780.39 OR ICD-10-CM: B02.23, F05, F06.8, F29, F44.5, G04.89, G04.90, G04.91, G40.%, G56.80, G56.90, G57.90, G57.91, G58.0, G58.7, G58.9, G60.3, G60.8, G60.9, G62.0, G62.2, G62.9, G63, G90.09, G96.9, M86.072, M86.179, M86.279, M86.8X8, M86.9, M89.60, R56.9) AND NOT ICD-9: 042,136.9, 250.60, 250.62, 357.2, 709.1, 457.1 ICD-10-CM: B20, B89, B99.9, E08.42, E09.42, E10.42, E11.40, E11.42, E13.42, I89.0, L95.9, G04.00, G04.01, G04.02, G04.2, G04.30, G04.31, G04.32, G04.39, G92 AND NOT the following if within 7 days of an inclusion code ICD-9: 959.% ICD-10: S09.8XXA, S09.90XA, S09.93XA, S19.9XXA, S29.8XXA, S39.81XA, S39.840A, S39.848A, S39.82XA, S49.80XA, S49.90XA, S59.809A, S59.819A, S59.909A, S59.919A, S69.80XA, S69.90XA, S79.819A, S79.829A, S79.919A, S79.929A, S89.80XA, S89.90XA, S99.819A, S99.919A, T07.XXXA, T14.90XA)</p>	
Oral Ulcer	ACR SLICC EULAR/ACR	<p>(ICD-9: 478.19, 528.2, 528.9, 529.9 OR ICD-10-CM: J34.1, J34.89, K12, K13.79) AND NOT (ICD-9: 054.9, 099.3, 136.1, 447.6, 536.8, 555.9, 560.89 OR ICD-10-CM: B00.9, K30, K50.90, K56.69, L95, M02.30, M35.2)</p>	Patients need to have 2 inclusion codes on ≥2 separate dates
Photosensitivity	ACR	<p>ICD-9: 692.72 OR ICD-10-CM: L56.0, L41.1, L41.8, L56.2</p>	
Renal Disease	ACR	<p>ICD9: 593.6, 593.81, 593.9, 791.7, 583.81, V13.09, 791.0, 583.8*, 583.9* OR ICD-10-CM: N28.9, N28.0, R80, R80.9, N08, Z87.448, R80.3, N05.8, N05.9 OR LOINC: 5820-6, 33825-1 (value >0 or >0/hpf or >0/lpf or presence), 51790-4, 33804-6, 5807-3, 5793-5, 25160-3</p>	
Renal Disease	SLICC	<p>ICD-9: 593.6, 593.81, 791.7 OR ICD-10-CM: N28.0, N28.9, R80, R80.9, R82.99 OR LOINC: 2889-4, 21482-5 (value >500mg (/24H), >0.5g (/24H)) OR LOINC: 51790-4, 33804-6, 5807-3 (value >0/hpf or /lpf)</p>	
Renal Disease	EULAR/ACR	<p>LOINC: 2889-4, 21482-5 (value >500mg/24H, >0.5g/24H)</p>	
Seizure	EULAR/ACR	<p>(ICD-9: 345.81, 345.90, 293.0, 345.50, 345.40, 345.10, 345.80, 345.9, 780.39, 298.9 OR ICD-10-CM: F44.5, G40.301, G40.009, G40.911, G40.89, G40.901, G40.201, G40.209, G40.501, G40.909) AND NOT (ICD-9: 042, 136.9, 250.60, 250.62, 357.2, 709.1, 457.1 ICD-10-CM: B20, B89, B99.9, E08.42, E09.42, E10.42, E11.40, E11.42, E13.42, I89.0, L95.9, G04.00, G04.01, G04.02, G04.2, G04.30, G04.31, G04.32, G04.39, G92 AND NOT the following if within 7 days of an inclusion code ICD-9: 959.* ICD-10: S09.8XXA, S09.90XA, S09.93XA, S19.9XXA, S29.8XXA, S39.81XA, S39.840A,</p>	

		S39.848A, S39.82XA, S49.80XA, S49.90XA, S59.809A, S59.819A, S59.909A, S59.919A, S69.80XA, S69.90XA, S79.819A, S79.829A, S79.919A, S79.929A, S89.80XA, S89.90XA, S99.819A, S99.919A, T07.XXXA, T14.90XA)	
Serositis	ACR SLICC EULAR/ACR	(ICD-9: 420.0, 420.9*, 423.2, 423.9, 511.0, 511.89, 511.9, 785.3, 786.51, 786.52, 786.7 OR ICD-10-CM: I30.0, I30.8, I30.9, I31.1, I31.3, I31.9, I32, J90, J91.8, J94.2, J94.8, J94.9, R07.1, R07.2, R07.81, R09.1, R09.89) AND NOT ICD-9: 041.9, 788.99 ICD-10-CM: B96.89, R30.1, R39.2, R39.82, R39.89 AND NOT the following if within 7 days of an inclusion code: ICD-9: 486, 415.1*, 416.2*, V12.55, 786.50, 410.*, 412.* ICD-10: J18.9, I26.*, I27.82, S09.8XXA, S09.90XA, S09.93XA, S19.9XXA, S29.8XXA, S39.81XA, S39.840A, S39.848A, S39.82XA, S49.80XA, S49.90XA, S59.809A, S59.819A, S59.909A, S59.919A, S69.80XA, S69.90XA, S79.819A, S79.829A, S79.919A, S79.929A, S89.80XA, S89.90XA, S99.819A, S99.919A, T07.XXXA, T14.90XA, Z48.89, I21.*, I22.*, I23.*, I25.2 CPT: 33510, 33511, 33512, 33513, 33514, 33515, 33516, 33517, 33518, 33519, 33520, 33521, 33522, 33523, 33530, 33533, 33534, 33535, 33536, 33542, 33545, 33548, 33390, 33391, 33474, 33927, 33928, 33929, 33930, 33933, 33935, 33940, 33944, 33945, 32035, 32036, 32096, 32097, 32098, 32100, 32110, 32120, 32124, 32140, 32141, 32150, 32151, 32160, 32505, 32506, 32507, 32440, 32442, 32445, 32480, 32482, 32484, 32486, 32488, 32491, 32503, 32504, 32850, 32851, 32852, 32853, 32854, 32905, 32906 ICD-9-Procedure-Codes: 35.1*, 36.1*, 37.5*, 35.51, 35.53, 36.03, 36.2, 37.33, 37.91, 39.61, 39.62, 07.12, 41.33, 43.89, 44.15, 45.15, 45.26, 45.7*, 48.25, 48.43, 48.52, 50.12, 50.23, 51.13, 52.12, 53.01, 53.02, 53.03, 53.04, 53.11, 53.12, 53.13, 53.14, 53.15, 53.16, 53.41, 53.49, 53.61, 53.69, 53.72, 53.84, 54.12, 55.24, 55.32, 56.34, 57.34, 57.59, 32.23 ICD-10-Procedure-Codes: 02xx0xx, 02YA*, 3E080GC, 0Dxx0xx, 0Fxx0xx, 0Yxx0xx, 0Bxx0xx, 0Wxx0xx, 07xx0xx, 0Gxx0xx, 0Txx0xx	patients need to have 2 inclusion codes on ≥ 2 separate dates
Thrombocytopenia	SLICC EULAR/ACR	LOINC: 26515-7, 777-3 (value < 100 K/uL) AND NOT the following if within 7 days of an inclusion code: ICD-9: 642.4*, 642.5*, 642.6*, 642.7* ICD-10: O14.*, O11.* AND NOT ICD-9: 287.39, 287.49, 572.3 ICD-10-CM: D69.49, D69.59, K76.6	

Supplemental Table 2: Sensitivity and Specificity of Classification Attributes for SLE Cohort, Healthy Cohort

Criterion	Classification Criteria Domain	Lupus Classification Criteria			SLE Cohort		Healthy Cohort		Combined	
		ACR 1997	SLICC 2012	EULAR / ACR 2019	Sensitivity	Specificity	Sensitivity	Specificity	Sensitivity	Specificity
Acute Cutaneous Lupus	Clinical		X	X	51.6%	56.9%	0%	99.6%	51.6%	94.7%
Alopecia	Clinical		X	X	13.5%	92.8%	56.3%	97.7%	13.5%	92.8%
Arthritis (Synovitis)	Clinical	X	X	X	8.1%	96.8%	2%	11.1%	75.6%	98.1%
Chronic Cutaneous Lupus	Clinical		X	X	58.3%	68.5%	0%	99.8%	58.3%	86.9%
Delirium	Clinical			X	0%	78.6%	0%	94.2%	0%	86.6%
Discoid Rash	Clinical	X			58.8%	64.8%	0%	99.2%	58.2%	84.4%
Fever	Clinical			X	25.9%	86.4%	0%	93.4%	25.9%	90.3%
Hematological Disorder	Clinical	X			98.6%	13.5%	50%	72.4%	96.9%	55.9%
Hemolytic Anemia	Clinical		X	X	22.7%	94.6%	0%	99.4%	22.2%	97.2%
Leukopenia	Clinical		X	X	93.1%	52.5%	83.3%	73.7%	92.9%	72.1%
Malar Rash	Clinical	X			31.6%	77.0%	0%	99.5%	31.5%	92.3%
Neurologic Disorder	Clinical	X			40.7%	87.2%	0%	95.5%	30.6%	91.6%
Neurologic Disorder	Clinical		X		49.0%	82.7%	11.1%	94.7%	45.9%	89.5%
Oral Ulcers	Clinical	X	X	X	6.8%	95.2%	0%	98.9%	6.8%	97.8%
Photosensitivity	Clinical	X			7.1%	94.6%	0%	99.4%	7.1%	98.3%
Renal Disorder	Clinical	X			91.5%	58.6%	33.3%	93.2%	87.6%	79.9%
Renal Disorder	Clinical		X		77.0%	72.1%	18.2%	94.1%	73.5%	85.8%
Renal Disorder	Clinical			X	68.3%	84.6%	11.1%	98.8%	63.6%	92.7%
Seizure	Clinical			X	54.8%	89.6%	38.5%	98.4%	50.0%	94.2%
Serositis	Clinical	X	X	X	29.9%	86.6%	0%	99.1%	28.4%	94.4%
Thrombocytopenia	Clinical		X	X	68.9%	88.9%	50%	99.4%	68.3%	94.6%
Anti-dsDNA Ab	Immunologic		X	X	93.6%	67.8%	0%	100%	92.8%	92.8%
Anti-Nuclear Ab	Immunologic	X	X	X	69.0%	41.2%	12.5%	97.1%	67.1%	95.2%
Anti-Phospholipid Ab	Immunologic		X	X	65.4%	83.8%	0%	99.0%	64.3%	92.8%
Anti-Smith Ab	Immunologic		X	X	52.4%	86.9%	0%	100%	52.4%	94.5%
Direct Coombs Test	Immunologic		X		16.7%	95%	0%	99.8%	16.7%	97.5%
Immunological Disorders	Immunologic	X			90.3%	59.5%	0%	99.8%	89.8%	92.4%
Low Complement	Immunologic		X		85.8%	84.4%	0%	100%	85.8%	96.4%
Low Complement C3	Immunologic			X	85.7%	81.2%	0%	100%	85.7%	94.5%
Low Complement C4	Immunologic			X	84.2%	90.3%	0%	100%	84.2%	97.2%