Supplemental Table 1. Clinically defined samples

Demographic and Clinical Variables	Definition
Age	Years at diagnosis
Sex	Female or male
Race/ethnicity	Asian: Chinese, Filipino, Japanese, Korean, others; African descendants: African, Caribbean; Hispanic: Hispanics only; White: North American, Indian – sub-continent, others; Other: Native North American, Native Hawaiian or other Pacific Islanders, others
Presence of nephritis	Based on renal biopsy or fulfillment of the renal item of the ACR Classification criteria
American College of Rheumatology (ACR) criteria	Number of specific ACR criteria fulfilled
SLE Disease Activity Index (SLEDAI-2K) score	Disease activity measured by global SLEDAI-2K score and its individual components grouped to represent the following organ systems: Neurological: seizures, psychosis, organic brain syndrome, visual disturbance, cranial nerve disorder, lupus headache, CVA Mucocutaneous: vasculitis, rash, alopecia, mucosal ulcers Musculoskeletal: arthritis, myositis Renal: urinary casts, hematuria, proteinuria, pyuria Serositis: pleurisy, pericarditis Constitutional: fever Immunological: low complement, increased DNA binding Hematological: thrombocytopenia, leukopenia
Medications	Any use of oral or parental glucocorticoids, antimalarials, immunosuppressive agents (methotrexate, azathioprine, mycophenolate, cyclophosphamide, cyclosporine, and biologics) at or prior to enrollment.

Supplemental Table 2. Patient characteristics at enrolment and year five (n=805)

Demographic and Clinical	Enrolment	Year 5	Difference[1] (95% CI)
Mean age at dx, yrs (SD)	35.2 (13.6)		
Female, %	88.7		
Mean disease duration, yrs (SD)	0.58 (0.49)		
Mean number of ACR Criteria without ANA (SD)	3.9 (1.0)		
Ethnicity, %			
Asian	24.3		
African	13.5		
White	52.3		
Hispanic	6.3		
Other ethnicities[2]	3.5		
Nephritis[3]	28.9	36.6	**7.7 (5.7, 9.7)**
Mean total SLEDAI-2K (SD)[4]	5.4 (5.3)	3 (3.5)	**-2.3 (-2.7, -1.9)**
Mean total SDI (SD)[5]	0.34 (0.74)	0.86 (1.25)	**0.52 (0.43, 0.62)**
Medications	**Enrolment**	**Year 5**	**Difference[1] (95% CI)**
Current, %			
Glucocorticoids	69.6	56.8	**-12.8 (-16.5, -9.1)**
Antimalarials	70.1	79.4	**9.3 (5.9, 12.7)**
Immunosuppressants	41.0	50.8	**9.8 (6.1, 13.5)**
Ever, %			
Glucocorticoids	81.5	87.3	**5.8 (4.1, 7.6)**
Antimalarials	76.6	91.1	**14.4 (11.9, 17)**
Immunosuppressants	43.9	66.3	**22.5 (19.5, 25.5)**

Abbreviations: ACR, American College of Rheumatology; ANA, anti-nuclear antibodies; β2GP1, β2-glycoprotein-1; CI, confidence interval; dx, diagnosis; dsDNA, double-stranded DNA; IgG/M, immunoglobulin G/immunoglobulin M; RNP, ribonucleoprotein; SD, standard deviation; SLEDAI-2K, systemic lupus erythematosus disease activity index-2000; SDI, SLICC Damage index; Sm, Smith; TRIM21, Tripartite Motif Protein (TRIM) 21; yrs, years.

1. Difference between enrolment and year 5 visit;
2. Other ethnicities include: Native North American, Native Hawaiian or other Pacific Islanders
3. Nephritis defined as fulfilling the ACR criterion for renal disease or if a renal biopsy was performed prior to cohort entry
4. Complete data available for n=793 patients
5. Complete data available for n= 380 as the disease needs to be present for at least 6 months before the SDI can be calculated.

Supplemental Table 3. Demographic and clinical characteristics at enrolment and ten-year follow-up between the four SLE longitudinal autoantibody clusters (all results)

	Cluster 1 (n=137)	Cluster 2 (n=376)	Cluster 3 (n=80)	Cluster 4 (n=212)	p-value	FDR
Enrolment Demographics						
% Female	89.8 (30.4)	89.4 (30.9)	81.2 (39.3)	89.6 (30.6)	0.177	0.588
Mean Age of Diagnosis (SD), yrs	31.5 (10.8)	36.5 (13.9)	32.5 (13.9)	34.4 (14.1)	**<0.001**	**0.014**
% Ethnicity						
White	32.1	61.7	68.8	42.5	**<0.001**	**<0.001**
Asian	30.7	20.5	13.8	31.1	**<0.001**	**0.014**
African	27.0	9.6	6.2	14.6	**<0.001**	**<0.001**
Hispanic	5.1	4.8	10.0	8.5	0.149	0.571
Other	5.1	3.5	1.3	3.3	0.516	0.954
% Country						
North America	48.6	51.8	54.9	45.5	0.433	0.859
Europe	27.0	32.8	29.6	29.4	0.661	1.000
Asia	24.3	15.4	15.5	25.1	0.0153	0.114
Mean BMI (SD), kg/m^2	24.3 (4.9)	25.6 (6.1)	26.1 (5.8)	24.1 (4.8)	**0.003**	**0.029**
% Smoker						
Former smoker	19.0	24.5	26.3	15.6	0.046	0.232
Current smoker	11.7	14.4	21.2	9.0	0.035	0.206
% Alcohol Abuse	0.7	1.3	2.5	1.4	0.758	1.000
% Completed Post Secondary Education	68.4	65.5	64.6	62.8	0.764	1.000
Clinical Characteristics at Year 10 Follow-Up						
% Nephritis[2]	56.2	32.1	50.9	46.9	**<0.001**	**0.001**
% Hypertension	59.0	50.0	49.1	52.5	0.447	0.793
Mean SLEDAI-2K Score (SD)						
Total Score[3]	3.2 (3.2)	2.3 (2.9)	3.0 (2.1)	3.5 (3.4)	**0.002**	**0.020**
Adjusted Mean Score[4]	4.2 (2.7)	2.6 (2.2)	3.5 (1.7)	3.9 (2.2)	**<0.001**	**<0.001**
Neurological Subscale	0.00 (0.00)	0.03 (0.53)	0.00 (0.00)	0.0 (0.0)	0.730	0.972
Musculoskeletal Subscale	0.16 (0.79)	0.40 (1.20)	0.15 (0.76)	0.19 (0.86)	0.084	0.326
Mucocutaneous Subscale	0.52 (1.41)	0.43 (1.26)	0.37 (0.96)	0.40 (1.19)	0.867	0.972
Renal Subscale	0.82 (2.07)	0.49 (1.68)	0.38 (1.18)	0.83 (2.11)	0.164	0.549
Serositis Subscale	0.00 (0.00)	0.02 (0.19)	0.04 (0.27)	0.03 (0.23)	0.631	0.886
Constitutive Subscale	0.00 (0.00)	0.00 (0.07)	0.00 (0.00)	0.00 (0.00)	0.730	0.972

Hematological Subscale	0.10 (0.30)	0.05 (0.21)	0.13 (0.34)	0.06 (0.23)	0.082	0.326
Immunological Subscale	1.64 (1.60)	0.90 (1.31)	1.96 (1.33)	2.01 (1.61)	**<0.001**	**<0.001**
Low Complement	0.85 (0.99)	0.50 (0.87)	1.19 (0.99)	0.97 (1.00)	**<0.001**	**<0.001**
Mean SLICC Damage Index (SD)[5]						
Ocular Domain	0.15 (0.36)	0.19 (0.47)	0.14 (0.35)	0.14 (0.38)	0.694	0.959
Neuropsychiatric Domain	0.12 (0.41)	0.18 (0.57)	0.37 (0.86)	0.11 (0.37)	0.012	0.066
Seizures	0.01 (0.10)	0.02 (0.16)	0.11 (0.31)	0.01 (0.8)	**<0.001**	**0.004**
Renal Domain	0.09 (0.28)	0.16 (0.57)	0.09 (0.43)	0.12 (0.44)	0.498	0.820
Pulmonary Domain	0.13 (0.42)	0.06 (0.27)	0.05 (0.23)	0.08 (0.29)	0.210	0.574
Cardiovascular Domain	0.03 (0.17)	0.08 (0.35)	0.11 (0.45)	0.09 (0.35)	0.429	0.777
Peripheral Vascular Domain	0.04 (0.19)	0.04 (0.22)	0.05 (0.23)	0.03 (0.18)	0.921	0.992
Gastrointestinal Domain	0.05 (0.21)	0.03 (0.19)	0.05 (0.29)	0.04 (0.19)	0.807	0.972
Musculoskeletal Domain	0.20 (0.54)	0.26 (0.63)	0.04 (0.19)	0.23 (0.59)	0.059	0.258
Skin Domain	0.248 (0.53)	0.08 (0.29)	0.07 (0.32)	0.07 (0.28)	**<0.001**	**0.002**
Alopecia	0.14 (0.35)	0.04 (0.19)	0.04 (0.19)	0.04 (0.19)	**<0.001**	**0.004**
Premature Gonadal Failure Domain	0.010 (0.10)	0.02 (0.14)	0.02 (0.13)	0.02 (0.14)	0.912	0.992
Diabetes Domain	0.03 (0.17)	0.04 (0.19)	0.02 (0.13)	0.04 (0.21)	0.789	0.972
Malignancy Domain	0.04 (0.19)	0.06 (0.26)	0.05 (0.23)	0.02 (0.14)	0.265	0.623
Medications Ever						
% Steroid	94.3	89.8	85.9	89.4	0.352	0.712
% Antimalarial	97.1	94.3	86.0	95.0	0.030	0.152
% Immunosuppressives/ Biologics	83.8	63.8	68.4	73.8	**0.002**	**0.014**
% Imuran	55.2	34.6	45.6	43.1	**0.003**	**0.025**
% Cyclophosphamide	16.2	20.3	22.8	18.8	0.732	0.972
% Methotrexate	23.8	18.7	15.8	23.8	0.401	0.754
% Cyclosporin	8.6	7.7	8.8	8.8	0.981	1.000
% Mycophenolic Acid	46.7	27.6	28.1	33.8	**0.005**	**0.031**
% Other	22.9	15.4	15.8	16.9	0.397	0.754
% Rituximab	8.6	4.5	7.0	5.6	0.490	0.820
% Belimumab	14.3	4.1	5.3	6.3	**0.005**	**0.031**
% Other biologic	5.7	4.1	0.0	6.3	0.240	0.613
Medications Current						

% Steroid	62.9	54.1	49.1	56.3	0.326	0.694
% Antimalarial	97.1	78.5	75.4	80.0	0.846	0.972
% Immunosuppressives/ Biologics	72.3	45.5	47.4	53.8	**<0.001**	**0.001**
% Imuran	33.3	15.0	15.8	13.1	**<0.001**	**0.001**
% Cyclophosphamide	0.0	0.4	0.0	1.9	0.205	0.574
% Methotrexate	8.6	7.7	5.3	9.4	0.792	0.972
% Cyclosporin	2.9	2.4	1.8	1.9	0.946	1.000
% Mycophenolic Acid	30.5	14.2	19.3	22.5	**0.005**	**0.031**
% Other	2.9	5.3	5.3	3.8	0.728	0.972
% Rituximab	1.9	1.2	1.8	1.3	0.955	1.000
% Belimumab	6.7	3.3	3.5	5.0	0.515	0.820
% Other biologic	1.9	2.4	0.0	0.6	0.381	0.752

1. Comparison between cluster groups using one-way ANOVA test and a Benjamini-Hochberg correction with false discovery rate (FDR) alpha = 0.05
2. LN was diagnosed by renal biopsy or fulfillment of the renal item on the ACR classification criteria.
3. The total score of SLEDAI-2K is the sum of all 24 descriptor scores. The total SLEDAI-2K score falls between 0 and 105, with higher scores representing higher disease activity.
4. A measurement of lupus disease activity over time determined by the calculation of the area under the curve of SLEDAI-2K over time by adding the area of each of the blocks of visit interval and then dividing by the length of time for the whole period.
5. Only reporting SLICC Damage Index domains and subdomains that are statistically significant.

Abbreviations: BMI, body mass index; SD, standard deviation; SLEDAI-2K, Systemic Lupus Erythematosus Disease Activity Index 2000; SLICC, Systemic Lupus International Collaborating Clinics; yrs, years.

Supplemental Table 4. Patient characteristics at enrolment comparing the subset of 581 patients included with 10-year follow-up clinical data vs. the subset of 224 patients excluded without 10-year follow-up data

	Subset Included (n=581)	Subset Excluded (n=224)	P-value[1]
Demographic and Clinical			
Mean age at dx, yrs (SD)	34.9 (13.8)	35.7 (13.1)	0.828
Female, %	88.5	89.3	0.943
Mean disease duration, yrs (SD)	0.58 (0.50)	0.60 (0.47)	0.878
Mean number of ACR Criteria without ANA (SD)	3.96 (1.1)	3.8 (0.9)	0.354
Ethnicity, %			
Asian	26.9	17.9	0.072
African	12.6	16.1	0.529
White	50.3	57.6	0.315
Hispanic	6.7	5.4	0.878
Other ethnicities[2]	3.6	3.1	0.953
Nephritis[3]	31.7	21.9	0.072
Mean total SLEDAI-2K (SD)	5.7 (5.5)	4.5 (4.6)	0.072
Mean total SDI (SD)	0.35 (0.79)	0.36 (0.76)	0.953
Medications			
Current, %			
Glucocorticoids	70.4	67.4	0.828
Antimalarials	68.2	75.0	0.315
Immunosuppressants	41.7	39.3	0.878
Ever, %			
Glucocorticoids	82.4	79.0	0.616
Antimalarials	75.2	80.4	0.375
Immunosuppressants	44.4	42.4	0.878

Abbreviations: ACR, American College of Rheumatology; ANA, anti-nuclear antibodies; dx, diagnosis; SD, standard deviation; SLEDAI-2K, systemic lupus erythematosus disease activity index-2000; SDI, SLICC Disease index; yrs, years.
1. Adjusted for multiple comparisons using Benjamini-Hochberg correction with false discovery rate (FDR) alpha = 0.05
2. Other ethnicities include Native North American, Native Hawaiian or other Pacific Islanders
3. Nephritis defined as fulfilling the ACR criterion for renal disease or if a renal biopsy was performed prior to cohort entry

Supplemental Table 5. Comparison of autoantibody frequency between clusters at each visit using one-way ANOVA test and a Benjamini-Hochberg correction with false discovery rate (FDR) alpha = 0.05

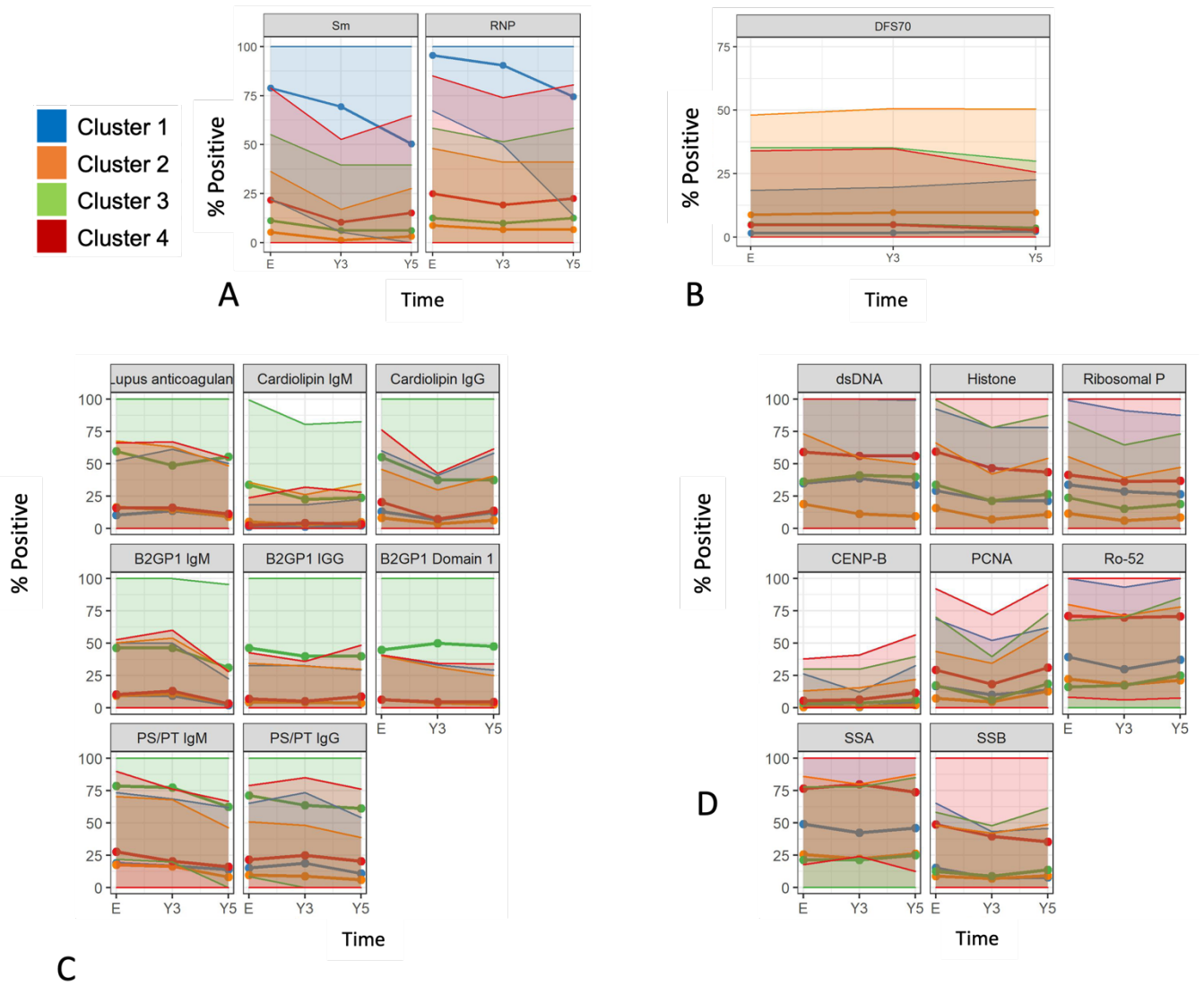| Visit	Biomarkers	Cluster 1 % Positive (95% CI)	Cluster 2 % Positive (95% CI)	Cluster 3 % Positive (95% CI)	Cluster 4 % Positive (95% CI)	FDR Adjusted P-value
Enrolment	Anti-Sm	79 (72-86)	5 (3-7)	11 (4-18)	22 (16-28)	<0.001
	Anti-U1RNP	96 (92-100)	9 (6-12)	13 (6-20)	25 (19-31)	<0.001
	Anti-DFS70	1 (-1-3)	9 (6-12)	5 (0-10)	5 (2-8)	1
	Anti-β2GP IgG	4 (0-8)	5 (3-7)	46 (35-57)	7 (4-10)	0.006
	Anti-β2GP IgM	9 (4-14)	10 (7-13)	46 (35-57)	10 (6-14)	0.117
	Anti-Cardiolipin IgG	13 (7-19)	8 (5-11)	55 (44-66)	20 (15-25)	<0.001
	Anti-Cardiolipin IgM	1 (-1-3)	5 (3-7)	34 (23-45)	2 (0-4)	0.23
	Anti-β2GP1-Domain 1 IgG	7 (3-11)	6 (4-8)	45 (34-56)	7 (4-10)	0.107
	Lupus Anticoagulant	9 (4-14)	16 (12-20)	65 (54-76)	15 (10-20)	0.019
	Anti-PS/PT IgG	15 (9-21)	10 (7-13)	71 (61-81)	22 (16-28)	<0.001
	Anti-PS/PT IgM	19 (12-26)	18 (14-22)	79 (70-88)	28 (22-34)	<0.001
	Anti-dsDNA	35 (27-43)	19 (15-23)	26 (25-47)	59 (52-66)	<0.001
	Anti-Histone	29 (21-37)	16 (12-20)	34 (23-45)	59 (52-66)	<0.001
	Anti-PCNA	17 (11-23)	7 (4-10)	18 (10-26)	29 (23-35)	<0.001
	Anti-Ribosomal P	34 (26-42)	11 (8-14)	24 (15-33)	42 (35-49)	<0.001
	Anti-Ro52/TRIM21	39 (31-47)	22 (18-26)	16 (8-24)	71 (65-77)	<0.001
	Anti-SSA/Ro60	49 (41-57)	26 (22-30)	21 (12-30)	76 (70-82)	<0.001
	Anti-SSB/La	15 (9-21)	9 (6-12)	13 (6-20)	49 (42-56)	<0.001
	Anti-CENP-B	3 (0-6)	1 (0-2)	4 (0-8)	6 (3-9)	0.017
	Anti-Jo-1	0 (0-0)	1 (0-2)	1 (0-3)	3 (1-5)	0.019
Visit 3	Anti-Sm	69 (61-77)	1 (0-2)	6 (1-11)	10 (6-14)	<0.001
	Anti-U1RNP	91 (86-96)	7 (4-10)	10 (3-17)	19 (14-24)	<0.001
	Anti-DFS70	2 (0-4)	10 (7-13)	5 (0-10)	5 (2-8)	0.873
	Anti-β2GP IgG	4 (0-8)	4 (2-6)	40 (29-51)	5 (2-8)	0.048
	Anti-β2GP IgM	9 (4-14)	11 (8-14)	46 (35-57)	13 (8-18)	0.031
	Anti-Cardiolipin IgG	7 (3-11)	4 (2-6)	38 (27-49)	7 (4-10)	0.033
	Anti-Cardiolipin IgM	1 (-1-3)	3 (1-5)	23 (14-32)	4 (1-7)	0.031
	Anti-β2GP1-Domain 1 IgG	4 (0-8)	4 (2-6)	51 (40-62)	5 (2-8)	0.024
	Lupus Anticoagulant	11 (6-16)	12 (9-15)	70 (60-80)	15 (10-20)	0.024
	Anti-PS/PT IgG	19 (12-26)	9 (6-12)	64 (53-75)	25 (19-31)	<0.001
	Anti-PS/PT IgM	17 (11-23)	16 (12-20)	78 (69-87)	20 (15-25)	0.006
	Anti-dsDNA	39 (31-47)	11 (8-14)	41 (30-52)	56 (49-63)	<0.001
	Anti-Histone	21 (14-28)	7 (4-10)	21 (12-30)	47 (40-54)	<0.001
	Anti-PCNA	10 (5-15)	5 (3-7)	6 (1-11)	18 (13-23)	<0.001
	Anti-Ribosomal P	28 (20-36)	6 (4-8)	15 (7-23)	36 (30-42)	<0.001
	Anti-Ro52/TRIM21	30 (22-38)	18 (14-22)	18 (10-26)	70 (64-76)	<0.001
	Anti-SSA/Ro60	42 (34-50)	22 (18-26)	21 (12-30)	80 (75-85)	<0.001
	Anti-SSB/La	7 (3-11)	7 (4-10)	9 (3-15)	40 (33-47)	<0.001
	Anti-CENP-B	1 (-1-3)	1 (0-2)	4 (0-8)	7 (4-10)	<0.001
	Anti-Jo-1	1 (-1-3)	1 (0-2)	0 (0-0)	1 (0-2)	0.9
Visit 5	Anti-Sm	50 (42-58)	3 (1-5)	6 (1-11)	15 (10-20)	<0.001
	Anti-U1RNP	74 (67-81)	7 (4-10)	13 (6-20)	23 (17-29)	<0.001
	Anti-DFS70	2 (-1-5)	10 (7-13)	4 (0-8)	3 (1-5)	0.253
	Anti-β2GP1 IgG	4 (1-7)	4 (2-6)	40 (29-51)	9 (5-13)	<0.001
	Anti-β2GP1 IgM	2 (-1-5)	3 (1-5)	31 (21-41)	3 (1-5)	0.086
	Anti-Cardiolipin IgG	12 (6-18)	6 (4-8)	38 (27-49)	14 (9-19)	0.022
	Anti-Cardiolipin IgM	2 (-1-5)	5 (3-7)	24 (15-33)	3 (1-5)	0.323
	Anti-β2GP1-Domain 1 IgG	4 (1-7)	3 (1-5)	48 (37-59)	5 (2-8)	0.006
	Lupus Anticoagulant	9 (4-14)	8 (5-11)	61 (50-72)	11 (7-15)	0.014
	Anti-PS/PT IgG	11 (6-16)	6 (4-8)	61 (50-72)	20 (15-25)	<0.001
	Anti-PS/PT IgM	14 (8-20)	8 (5-11)	63 (52-74)	16 (11-21)	0.002
	Anti-dsDNA	34 (26-42)	9 (6-12)	40 (29-51)	56 (49-63)	<0.001
	Anti-Histone	21 (14-28)	11 (8-14)	26 (16-36)	43 (36-50)	<0.001
	Anti-PCNA	14 (8-20)	13 (10-16)	19 (10-28)	31 (25-37)	<0.001
	Anti-Ribosomal P	26 (19-33)	9 (6-12)	19 (10-28)	37 (31-43)	<0.001
	Anti-Ro52/TRIM21	37 (29-45)	21 (17-25)	25 (15-35)	71 (65-77)	<0.001
	Anti-SSA/Ro60	46 (38-54)	26 (22-30)	25 (15-35)	74 (68-80)	<0.001
	Anti-SSB/La	8 (3-13)	9 (6-12)	14 (6-22)	35 (29-41)	<0.001
	CENP-B	4 (0-8)	2 (1-3)	6 (1-11)	12 (8-16)	<0.001
	Anti-Jo-1	1 (-1-3)	2 (0-4)	8 (2-14)	7 (4-10)	0.002

Abbreviations: β2GP1, β2-glycoprotein-1; CENP, centromere protein; DFS, dense fine speckled; dsDNA, double-stranded DNA; FDR, false discovery rate; ICAP, Jo-1, histidyl tRNA synthetase; PCNA, proliferating cell nuclear antigen; PS/PT, phosphatidyl serine-prothrombin complex; RNP, ribonucleoprotein; Sm, Smith antigen (U2-U6 RNP) ; SSA, Sjögren syndrome antigen A or Ro60: SSB, Sjögren syndrome antigen B or La: TRIM21, Tripartite Motif Protein (TRIM) 21.

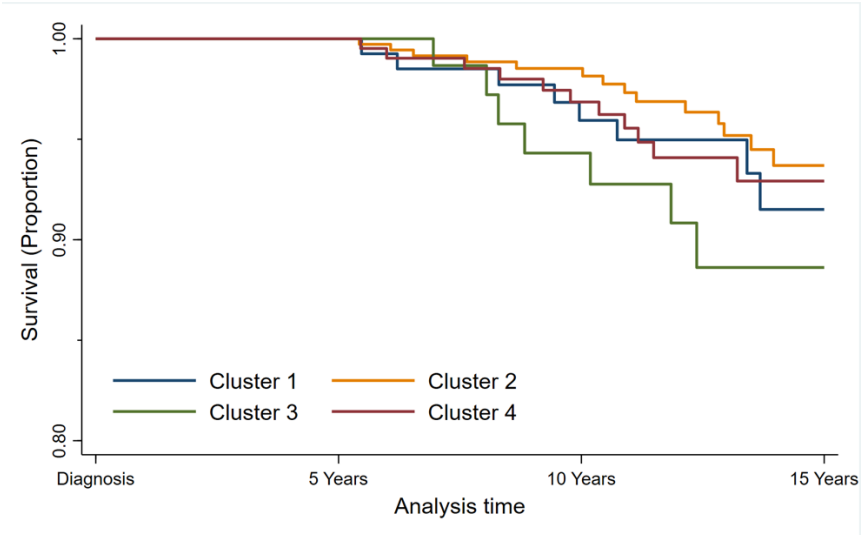**Supplemental Table 6. Titres of antiphospholipid antibodies over time.**

Antibody Titre	Cluster 1 (n=137)			Cluster 2 (n=376)			Cluster 3 (n=80)			Cluster 4 (n=212)		
	Enrolment	Y3	Y5	Enrolment	Y3	Y5	Enrolment	Y3	Y5	Enrolment	Y3	Y5
Anti-β2GP1 IgG	8.51	6.69	6.06	18.05	6.14	5.75	134.66	131.66	134.17	7.70	6.57	7.62
Anti-β2GP1 IgM	6.39	6.00	7.50	5.74	6.91	4.86	50.50	48.19	62.41	8.85	7.84	11.25
Anti-Cardiolipin IgG	9.23	7.72	3.93	10.51	9.71	5.15	78.24	88.70	50.15	10.10	11.88	6.04
Anti-Cardiolipin IgM	22.65	16.96	22.69	18.87	13.53	17.15	73.40	43.65	45.90	26.47	18.30	24.02
Anti-β2GP1-Domain 1	13.48	10.40	10.78	14.76	12.02	13.74	42.71	28.96	33.34	14.19	12.18	11.25
Anti-PS/PT IgG	20.64	20.85	18.41	16.11	14.50	12.18	94.31	82.58	78.52	28.33	25.98	23.67
Anti-PS/PT IgM	25.60	19.47	16.32	21.26	19.49	12.55	171.60	157.95	125.13	31.06	23.17	23.95

Darker red shading indicates higher frequency, lighter shading indicates lower frequency of autoantibody

Supplementary Figure 1. ANA and Autoantibody Profiles by Cluster including 95% Confidence Intervals

Supplemental Figure 2. Kaplan-Meier survival curves.

Supplemental Figure 3. Individual and cumulative explained variance for the 10 principal components