

Supplementary Table 1 Definitions and Calculation Formulas for Composite Indices

Index	Calculation Formula
BMI	Weight (kg) / Height ² (m ²)
SIRI	Neutrophil count (×10 ⁹ /L) × Monocyte count (×10 ⁹ /L) / Lymphocyte count (×10 ⁹ /L)
PLR	Platelet count (×10 ⁹ /L) / Lymphocyte count (×10 ⁹ /L)
LMR	Lymphocyte count (×10 ⁹ /L) / Monocyte count (×10 ⁹ /L)
PNI	Serum albumin (g/L) + 5 × Lymphocyte count (×10 ⁹ /L)
CAR	C-reactive protein (mg/L) / Serum albumin (g/L)
LCR	Lymphocyte count (×10 ⁹ /L) / C-reactive protein (mg/L)
mGPS	CRP ≤ 10 mg/L = 0 points; CRP > 10 mg/L and albumin ≥ 35 g/L = 1 point; CRP > 10 mg/L and albumin < 35 g/L = 2 points
FAR	Fibrinogen (g/L) / Serum albumin (g/L)
TyG-BMI	ln [Triglycerides (mg/dL) × Fasting plasma glucose (mg/dL) / 2] × BMI (kg/m ²)
ApoB/ApoA1	Apolipoprotein B (g/L) / Apolipoprotein A1 (g/L)
FHR	Fibrinogen (g/L) / High-density lipoprotein cholesterol (mmol/L)

Notes: a. The above composite indices are all dimensionless ratios, but their numerical values and clinical interpretation are influenced by the units of the original variables. In this study, the units of all original variables are consistent with the internationally accepted units listed above. When the denominator variable equals zero (e.g., CRP = 0 mg/L rendering LCR incalculable), the lower limit of detection for that variable was used as a substitute (the lower limit of detection for CRP was 0.05 mg/L). b. The original units of triglycerides and fasting plasma glucose are mmol/L. Unit conversion was performed during TyG-BMI calculation (TG: 1 mmol/L = 88.57 mg/dL; FPG: 1 mmol/L = 18.02 mg/dL).

Supplementary Table 2 Comparison of Baseline Characteristics Among the Training Set, Internal Validation Set, and External Validation Set

Variable	Training Set (n = 621)	Internal Validation Set (n = 267)	External Validation Set (n = 358)	P-value
Events, n (%)	199 (32.0%)	86 (32.2%)	103 (28.8%)	
Age	66.00 (58.00-73.00)	66.00 (59.00-73.00)	67.00 (60.00-75.00)	0.0788
Female	274 (44.1%)	119 (44.6%)	147 (41.1%)	0.5839
Male	347 (55.9%)	148 (55.4%)	211 (58.9%)	
BMI	22.66 (20.08-24.84)	22.86 (20.20-24.82)	22.74 (20.69-25.31)	0.214
Smoking				0.3407
Yes	197 (31.7%)	86 (32.2%)	99 (27.7%)	
No	424 (68.3%)	181 (67.8%)	259 (72.3%)	
Drinking				0.3149
Yes	168 (27.1%)	76 (28.5%)	84 (23.5%)	
No	453 (72.9%)	191 (71.5%)	274 (76.5%)	
SIRI	0.96 (0.54-1.92)	0.87 (0.55-1.40)	0.85 (0.53-1.57)	0.3057
PLR	147.37 (106.98-213.40)	141.61 (106.48-205.36)	136.35 (100.47-192.34)	0.0368
LMR	3.23 (2.02-4.52)	3.51 (2.40-4.58)	3.66 (2.41-4.87)	0.0045
CAR	0.06 (0.01-0.50)	0.09 (0.02-0.46)	0.07 (0.02-0.32)	0.6397
LCR	0.46 (0.06-1.88)	0.38 (0.08-1.60)	0.53 (0.11-1.76)	0.4052

mGPS												0.4037
0		425 (68.4%)		182 (68.2%)		258 (72.1%)						
1		73 (11.8%)		37 (13.9%)		46 (12.8%)						
2		123 (19.8%)		48 (18.0%)		54 (15.1%)						
PNI		43.00 (39.40-47.05)		43.45 (40.25-47.38)		44.45 (40.99-47.64)						0.0165
FAR		0.09 (0.07-0.12)		0.09 (0.07-0.12)		0.09 (0.07-0.11)						0.3629
TyG-BMI		196.69 (169.99-221.02)		198.39 (172.74-221.22)		197.18 (180.20-230.67)						0.0695
ApoB/ApoA1		0.76 (0.58-0.97)		0.73 (0.55-0.96)		0.75 (0.58-1.02)						0.2201
FHR		2.88 (2.23-3.93)		2.86 (2.25-4.18)		2.98 (2.24-3.93)						0.839

Supplementary Table 3 Layer 1 (Demographic Characteristics): Comparison of Internal Validation Performance Across 14 Algorithms

Algorit hm	AU C	AUC (95% CI)	AUP RC	Brier	ABsc ore	Accur acy	Sensiti vity	Specifi city	F1	PPV	NPV	Optima l Thresh old
KNN	0.70 38	0.639 3- 0.768 7	0.483 5	0.20 38	0.836 1	0.6517	0.6628	0.6464	0.55 07	0.47 11	0.80 14	0.4286
MLP	0.69 57	0.625 7- 0.764 6	0.531 2	0.2	0.875 4	0.6404	0.7442	0.5912	0.57 14	0.46 38	0.82 95	0.2715
GBDT	0.69 24	0.624 2- 0.764 9	0.556 6	0.19 42	0.965 1	0.6442	0.7209	0.6077	0.56 62	0.46 62	0.82 09	0.2907
RotF	0.67 79	0.604 3- 0.743 9	0.562 9	0.20 14	0.797 3	0.7266	0.4302	0.8674	0.50 34	0.60 66	0.76 21	0.471
LightG BM	0.66 61	0.595 7- 0.734 2	0.508 3	0.20 13	0.762 4	0.6517	0.6047	0.674	0.52 79	0.46 85	0.78 21	0.3443
GAM	0.66 29	0.590 7- 0.730 0	0.470 5	0.20 84	0.630 9	0.603	0.7442	0.5359	0.54 7	0.43 24	0.81 51	0.2664
RF	0.64 72	0.574 3- 0.712 4	0.494 2	0.20 59	0.626	0.6367	0.593	0.6575	0.51 26	0.45 13	0.77 27	0.3408
DT	0.63 12	0.562 2- 0.694 2	0.401 3	0.21 4	0.438 8	0.5805	0.6744	0.5359	0.50 88	0.40 85	0.77 6	0.3676
SVM	0.62 16	0.543 5- 0.700	0.442 7	0.21 4	0.408 8	0.6592	0.5581	0.7072	0.51 34	0.47 52	0.77 11	0.2914

		4										
ExtraTrees	0.6057	0.5272-0.6758	0.4281	0.2135	0.3688	0.6592	0.4186	0.7735	0.4417	0.4675	0.7368	0.3405
LR	0.5652	0.4929-0.6363	0.3829	0.2165	0.1933	0.5918	0.5581	0.6077	0.4683	0.4034	0.7432	0.3205
XGBoost	0.5611	0.4930-0.6271	0.3629	0.2171	0.171	0.5918	0.593	0.5912	0.4834	0.408	0.7535	0.3587
AdaBoost	0.5541	0.4858-0.6174	0.357	0.2235	0.0406	0.5805	0.5	0.6188	0.4343	0.3839	0.7226	0.3033
NB	0.5408	0.4682-0.6136	0.3601	0.2199	0.0614	0.4906	0.7558	0.3646	0.4887	0.3611	0.7586	0.2924

Supplementary Table 4 Layer 2 (Demographic Characteristics + Inflammatory Indices): Comparison of Internal Validation Performance Across 14 Algorithms

Algorithm	AUC	AUC (95% CI)	AUPRC	Brier	ABScore	Accuracy	Sensitivity	Specificity	F1	PPV	NPV	Optimal Threshold
LightGBM	0.7448	0.6768-0.8028	0.573	0.1856	0.9953	0.7041	0.7326	0.6906	0.6146	0.5294	0.8446	0.3339
GBDT	0.7406	0.6748-0.8015	0.5636	0.1848	0.9824	0.6891	0.7907	0.6409	0.621	0.5113	0.8657	0.3025
RotF	0.7302	0.6624-0.7963	0.5464	0.1915	0.8982	0.6816	0.7791	0.6354	0.6119	0.5038	0.8582	0.3555
RF	0.7273	0.6611-0.7877	0.533	0.193	0.8766	0.7228	0.6279	0.768	0.5934	0.5625	0.8129	0.3782
DT	0.7096	0.6463-0.7688	0.4685	0.1951	0.7902	0.6667	0.7442	0.6298	0.5899	0.4885	0.8382	0.4217
ExtraTrees	0.7079	0.6414-0.7726	0.5005	0.2011	0.7462	0.6442	0.7558	0.5912	0.5778	0.4676	0.8359	0.3236
SVM	0.706	0.6379-0.768	0.5211	0.1982	0.756	0.6105	0.8372	0.5028	0.5806	0.4444	0.8667	0.2797

		7										
AdaBoost	0.7052	0.6346-0.7666	0.4887	0.1996	0.7443	0.6255	0.8023	0.5414	0.5798	0.4539	0.8522	0.3287
XGBoost	0.6896	0.6188-0.7517	0.4661	0.1991	0.6824	0.6667	0.7442	0.6298	0.5899	0.4885	0.8382	0.3259
MLP	0.6686	0.6063-0.7398	0.4773	0.2657	0.1836	0.7079	0.5116	0.8011	0.5301	0.55	0.7754	0.5459
GAM	0.6647	0.5944-0.7370	0.4728	0.2036	0.5518	0.7004	0.4884	0.8011	0.5122	0.5385	0.7672	0.4263
KNN	0.6615	0.5967-0.7266	0.4519	0.2168	0.4568	0.588	0.686	0.5414	0.5175	0.4155	0.784	0.4286
LR	0.6461	0.5746-0.7132	0.4342	0.2082	0.4458	0.6479	0.5465	0.6961	0.5	0.4608	0.7636	0.3803
NB	0.6243	0.5544-0.6960	0.4302	0.2524	0.0821	0.6554	0.5	0.7293	0.4831	0.4674	0.7543	0.5536

Supplementary Table 5 Layer 3 (Demographic Characteristics + Lipid Metabolism Indices): Comparison of Internal Validation Performance Across 14 Algorithms

Algorithm	AUC	AUC (95% CI)	AUPRC	Brier	ABscore	Accuracy	Sensitivity	Specificity	F1	PPV	NPV	Optimal Threshold
MLP	0.7459	0.6739-0.8087	0.6255	0.1994	0.8301	0.7416	0.6512	0.7845	0.6188	0.5895	0.8256	0.398
SVM	0.7166	0.6519-0.7757	0.5143	0.2015	0.6292	0.633	0.8488	0.5304	0.5984	0.462	0.8807	0.247
GBDT	0.6957	0.6268-0.7649	0.5369	0.1945	0.779	0.6891	0.5698	0.7459	0.5414	0.5158	0.7849	0.3681
LightGBM	0.6945	0.6238-0.7603	0.5146	0.1969	0.6903	0.6929	0.6628	0.7072	0.5816	0.5182	0.8153	0.3475
RF	0.6875	0.6155-0.755	0.5078	0.1997	0.562	0.6629	0.6977	0.6464	0.5714	0.4839	0.8182	0.3374

		1										
KNN	0.68 67	0.619 1- 0.752 3	0.463 5	0.20 8	0.273 2	0.6517	0.6163	0.6685	0.53 27	0.46 9	0.78 57	0.4286
GAM	0.67 63	0.610 0- 0.744 7	0.512 7	0.19 89	0.542	0.5356	0.8953	0.3646	0.55 4	0.40 1	0.88	0.2321
DT	0.67 56	0.606 4- 0.739 2	0.455 7	0.20 64	0.277 3	0.6592	0.5698	0.7017	0.51 85	0.47 57	0.77 44	0.3893
RotF	0.67 17	0.600 7- 0.741 5	0.485 4	0.20 17	0.425 3	0.6854	0.5698	0.7403	0.53 85	0.51 04	0.78 36	0.3706
AdaBoo st	0.66 92	0.596 5- 0.735 7	0.463 1	0.20 55	0.280 2	0.6517	0.6047	0.674	0.52 79	0.46 85	0.78 21	0.2613
LR	0.66 81	0.597 8- 0.737 1	0.522 5	0.20 08	0.439 9	0.6255	0.6512	0.6133	0.52 83	0.44 44	0.78 72	0.309
ExtraTr ees	0.66 08	0.590 0- 0.731 0	0.488 3	0.20 78	0.166 5	0.5468	0.8256	0.4144	0.53 99	0.40 11	0.83 33	0.2904
XGBoo st	0.65 19	0.577 0- 0.721 5	0.463 4	0.20 45	0.239	0.6255	0.6395	0.6188	0.52 38	0.44 35	0.78 32	0.3184
NB	0.63 25	0.558 8- 0.710 4	0.487 9	0.20 9	0.0	0.5768	0.7558	0.4917	0.53 5	0.41 4	0.80 91	0.2213

Supplementary Table 6 SHAP Importance Ranking of All 16 Features

Feature	Mean SHAP Value
LCR	0.2560782616578385
BMI	0.2350613515891194
ApoB/ApoA1	0.1484803672185635
CAR	0.1269661661972713
TyG-BMI	0.1244127786211726
FHR	0.0952203313594385
FAR	0.0924828973923592
LMR	0.0899458868684409
PLR	0.0581990446529733
Age	0.0493452622413649
Sex	0.0226800696474317
SIRI	0.0193353348405112

PNI	0.0191159193969107
Drinking	0.0119120786871289
Smoking	0.0037303316342709
mGPS	0.0014173877778062
