Supplementary Table S1. Comparison of Fit Indices between Latent Class Growth Model (LCGM) and Growth Mixture Model (GMM) for Depressive Symptom Trajectories

Model	Class	SABIC	Entropy	VLMR-LRT *p*	BLRT *p*	Smallest Class (%)
LCGM	2	46996.69	0.82	-	-	17.6
LCGM	3	46742.96	0.80	<0.005	<0.05	10.4
LCGM	4	46229.11	0.80	<0.005	0.999	5.7
LCGM	5	45899.43	0.81	<0.005	0.774	4.1
LCGM	6	45704.37	0.79	<0.005	0.258	3.8
GMM	3	46742.96	0.80	<0.005	<0.005	10.4

Supplementary Table S2. Comparison of baseline characteristics betwen participants included (n=6125) , and excluded (n=5481)

Characteristic	Included (n=6125)	Excluded (n=5481)	P value[α]
Age group, n (%)			< 0.001
<60 years	2680 (43.8%)	3105 (56.7%)	
60-69 years	2282 (37.3%)	1620 (29.6%)	
70-79 years	989 (16.1%)	587 (10.7%)	
≥80 years	174 (2.8%)	161 (2.9%)	
Gender, n (%)			< 0.001
Male	2956 (48.3%)	2460 (44.9%)	
Female	3169 (51.7%)	3021 (55.1%)	
Education level, n (%)			< 0.001
Vocational school	2929 (47.8%)	2458 (44.8%)	
College (2-3 year)	1411 (23.0%)	1128 (20.6%)	
College (4 year)	1224 (20.0%)	1198 (21.9%)	
Others	561 (9.2%)	697 (12.7%)	

Living area, n (%)			< 0.001
Rural	4227 (69.0%)	3409 (62.2%)	
Urban	1898 (31.0%)	2072 (37.8%)	
Province, n (%)			<0.001
Eastern	1823 (30.9%)	1874 (35.2%)	
Central	1893 (32.1%)	1494 (28.1%)	
Western	1807 (30.6%)	1577 (29.7%)	
Northeast	373 (6.3%)	373 (7.0%)	
Smoking, n (%)			
Ever smoking	1689 (27.6%)	1458 (26.6%)	0.247
Current drinking	2630 (42.9%)	2256 (41.2%)	0.055
Drinking, n (%)			
Current drinking, n (%)	2000 (32.7%)	1796 (32.8%)	0.911
Ever drinking, n (%)	2625 (42.9%)	2342 (42.7%)	0.904
Regular exercise, n (%)	4018 (93.3%)	3475 (92.7%)	0.333
Social activities, n (%)	2823 (46.1%)	2850 (52.0%)	<0.001
High blood pressure, n (%)	1818 (29.8%)	1403 (25.7%)	<0.001

Diabetes, n (%)	454 (7.5%)	363 (6.7%)	0.108
Dyslipidemia, n (%)	750 (12.5%)	648 (12.0%)	0.519
Chronic disease, n (%)	4476 (73.1%)	3902 (71.2%)	0.025
Disability, n (%)	1666 (27.2%)	1422 (25.9%)	0.132
Teeth problems, n (%)	827 (13.5%)	620 (11.3%)	<0.001
Hip fracture, n (%)	24 (0.4%)	16 (0.3%)	0.448
Body pain, n (%)	1894 (30.9%)	1573 (28.7%)	0.010
ADL/IADL difficulties, n (%)	888 (14.5%)	781 (14.2%)	0.720
BMI category, n (%)			<0.001
Underweight (<18.5)	269 (4.4%)	460 (8.7%)	
Normal (18.5-24.9)	2976 (48.6%)	2938 (55.4%)	
Overweight/Obese (≥25.0)	2880 (47.0%)	1901 (35.9%)	
Waist circumference category, n (%)			<0.001
Normal	3112 (50.8%)	3437 (64.6%)	
Central obesity	3013 (49.2%)	1887 (35.4%)	
CESD-10 score	8.16 ± 5.05	8.18 ± 5.11	0.795

Depressive symptoms (CESD≥10), n (%)	1945 (31.8%)	1745 (31.9%)	0.958
Total cognition score	11.39 ± 3.35	11.49 ± 3.40	0.104
Self-rated health (1-5)	3.00 ± 0.72	3.01 ± 0.75	0.422
Life satisfaction (1-5)	3.20 ± 0.55	3.18 ± 0.58	0.010
Sleep quality (1-4)	2.68 ± 0.58	2.68 ± 0.58	0.948
Income level, n (%)			0.005
<4999 yuan	2674 (51.3%)	2052 (48.0%)	
5000-9999 yuan	357 (6.8%)	321 (7.5%)	
≥10000 yuan	2182 (41.9%)	1906 (44.5%)	

Supplementary Table S3

Supplementary Table S3a. Detailed per-class performance metrics for all models across three datasets

Dataset	Model	Class	Precision	Recall	F1-Score	Support
Dataset_01	LogisticRegression	1	0.98	0.81	0.89	3237
Dataset_01	LogisticRegression	2	0.04	0.49	0.08	43
Dataset_01	LogisticRegression	3	0.33	0.29	0.31	387
Dataset_01	LogisticRegression	4	0.3	0.56	0.39	197
Dataset_01	RandomForest	1	0.93	0.97	0.95	3237
Dataset_01	RandomForest	2	0	0	0	43
Dataset_01	RandomForest	3	0.51	0.47	0.48	387
Dataset_01	RandomForest	4	0.46	0.26	0.33	197
Dataset_01	XGBoost	1	0.94	0.95	0.94	3237
Dataset_01	XGBoost	2	0.22	0.05	0.08	43
Dataset_01	XGBoost	3	0.44	0.44	0.44	387
Dataset_01	XGBoost	4	0.35	0.35	0.35	197
Dataset_01	MLP	1	0.96	0.87	0.91	3237
Dataset_01	MLP	2	0.09	0.35	0.14	43
Dataset_01	MLP	3	0.34	0.36	0.35	387
Dataset_01	MLP	4	0.3	0.57	0.39	197
Dataset_01	RNN	1	0.97	0.82	0.89	3237
Dataset_01	RNN	2	0.04	0.44	0.08	43
Dataset_01	RNN	3	0.33	0.28	0.3	387
Dataset_01	RNN	4	0.31	0.57	0.4	197
Dataset_01	LSTM	1	0.96	0.86	0.91	3237
Dataset_01	LSTM	2	0.09	0.37	0.14	43

Dataset	Model	Class	Precision	Recall	F1-Score	Support
Dataset_01	LSTM	3	0.36	0.4	0.38	387
Dataset_01	LSTM	4	0.29	0.53	0.38	197
Dataset_01	Transformer	1	0.95	0.9	0.93	3237
Dataset_01	Transformer	2	0.11	0.19	0.14	43
Dataset_01	Transformer	3	0.4	0.42	0.41	387
Dataset_01	Transformer	4	0.3	0.48	0.37	197
Dataset_02	LogisticRegression	1	0.95	0.81	0.87	1610
Dataset_02	LogisticRegression	2	0.03	0.41	0.06	17
Dataset_02	LogisticRegression	3	0.44	0.34	0.38	355
Dataset_02	LogisticRegression	4	0.28	0.43	0.34	184
Dataset_02	RandomForest	1	0.9	0.96	0.93	1610
Dataset_02	RandomForest	2	0	0	0	17
Dataset_02	RandomForest	3	0.56	0.52	0.54	355
Dataset_02	RandomForest	4	0.28	0.17	0.21	184
Dataset_02	XGBoost	1	0.91	0.95	0.93	1610
Dataset_02	XGBoost	2	0.11	0.06	0.08	17
Dataset_02	XGBoost	3	0.55	0.54	0.55	355
Dataset_02	XGBoost	4	0.38	0.28	0.32	184
Dataset_02	MLP	1	0.93	0.88	0.9	1610
Dataset_02	MLP	2	0.11	0.24	0.15	17
Dataset_02	MLP	3	0.45	0.34	0.38	355
Dataset_02	MLP	4	0.29	0.55	0.38	184
Dataset_02	RNN	1	0.95	0.82	0.88	1610
Dataset_02	RNN	2	0.03	0.41	0.06	17
Dataset_02	RNN	3	0.42	0.31	0.36	355

Dataset	Model	Class	Precision	Recall	F1-Score	Support
Dataset_02	RNN	4	0.28	0.46	0.35	184
Dataset_02	LSTM	1	0.94	0.86	0.9	1610
Dataset_02	LSTM	2	0.04	0.12	0.06	17
Dataset_02	LSTM	3	0.43	0.39	0.41	355
Dataset_02	LSTM	4	0.3	0.52	0.38	184
Dataset_02	Transformer	1	0.94	0.86	0.9	1610
Dataset_02	Transformer	2	0.03	0.06	0.04	17
Dataset_02	Transformer	3	0.45	0.4	0.42	355
Dataset_02	Transformer	4	0.29	0.54	0.38	184
Dataset_03	LogisticRegression	1	0.92	0.83	0.87	985
Dataset_03	LogisticRegression	2	0.01	0.08	0.01	12
Dataset_03	LogisticRegression	3	0.48	0.29	0.36	238
Dataset_03	LogisticRegression	4	0.28	0.46	0.35	103
Dataset_03	RandomForest	1	0.87	0.96	0.91	985
Dataset_03	RandomForest	2	0	0	0	12
Dataset_03	RandomForest	3	0.48	0.42	0.45	238
Dataset_03	RandomForest	4	0.35	0.14	0.2	103
Dataset_03	XGBoost	1	0.88	0.94	0.91	985
Dataset_03	XGBoost	2	0	0	0	12
Dataset_03	XGBoost	3	0.48	0.42	0.45	238
Dataset_03	XGBoost	4	0.31	0.21	0.25	103
Dataset_03	MLP	1	0.9	0.89	0.9	985
Dataset_03	MLP	2	0	0	0	12
Dataset_03	MLP	3	0.44	0.3	0.36	238
Dataset_03	MLP	4	0.26	0.46	0.33	103

Dataset	Model	Class	Precision	Recall	F1-Score	Support
Dataset_03	RNN	1	0.92	0.84	0.88	985
Dataset_03	RNN	2	0.01	0.08	0.01	12
Dataset_03	RNN	3	0.52	0.29	0.37	238
Dataset_03	RNN	4	0.28	0.48	0.36	103
Dataset_03	LSTM	1	0.92	0.85	0.88	985
Dataset_03	LSTM	2	0	0	0	12
Dataset_03	LSTM	3	0.45	0.37	0.4	238
Dataset_03	LSTM	4	0.27	0.43	0.33	103
Dataset_03	Transformer	1	0.92	0.86	0.89	985
Dataset_03	Transformer	2	0	0	0	12
Dataset_03	Transformer	3	0.46	0.3	0.36	238
Dataset_03	Transformer	4	0.27	0.58	0.37	103

Supplementary Table S3b. Confusion matrices for all models across three datasets

Dataset	Model	Actual Class	Predicted: 1	Predicted: 2	Predicted: 3	Predicted: 4
Dataset_01	LogisticRegression	1	2623	302	180	132
Dataset_01	LogisticRegression	2	6	21	10	6
Dataset_01	LogisticRegression	3	47	113	112	115
Dataset_01	LogisticRegression	4	14	40	33	110
Dataset_01	RandomForest	1	3148	0	69	20
Dataset_01	RandomForest	2	20	0	20	3
Dataset_01	RandomForest	3	170	0	180	37
Dataset_01	RandomForest	4	59	0	87	51
Dataset_01	XGBoost	1	3061	3	117	56
Dataset_01	XGBoost	2	20	2	15	6
Dataset_01	XGBoost	3	148	1	170	68
Dataset_01	XGBoost	4	42	3	83	69
Dataset_01	MLP	1	2803	114	196	124
Dataset_01	MLP	2	8	15	11	9
Dataset_01	MLP	3	74	41	138	134
Dataset_01	MLP	4	20	5	60	112
Dataset_01	RNN	1	2643	285	179	130
Dataset_01	RNN	2	7	19	10	7
Dataset_01	RNN	3	54	107	109	117
Dataset_01	RNN	4	13	39	32	113
Dataset_01	LSTM	1	2786	117	202	132
Dataset_01	LSTM	2	8	16	13	6

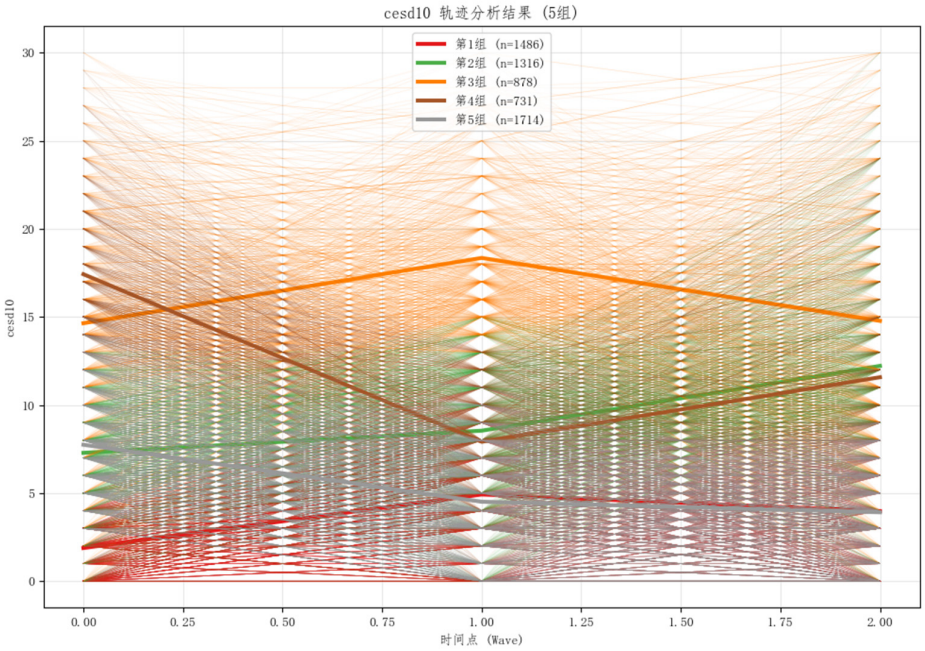
Dataset_01	LSTM	3	73	41	156	117
Dataset_01	LSTM	4	22	10	60	105
Dataset_01	Transformer	1	2919	52	161	105
Dataset_01	Transformer	2	13	8	14	8
Dataset_01	Transformer	3	105	11	162	109
Dataset_01	Transformer	4	26	4	72	95
Dataset_02	LogisticRegression	1	1310	104	104	92
Dataset_02	LogisticRegression	2	1	7	7	2
Dataset_02	LogisticRegression	3	49	78	119	109
Dataset_02	LogisticRegression	4	26	36	43	79
Dataset_02	RandomForest	1	1548	0	42	20
Dataset_02	RandomForest	2	3	0	10	4
Dataset_02	RandomForest	3	111	2	184	58
Dataset_02	RandomForest	4	62	0	90	32
Dataset_02	XGBoost	1	1522	0	66	22
Dataset_02	XGBoost	2	3	1	13	0
Dataset_02	XGBoost	3	90	8	193	64
Dataset_02	XGBoost	4	53	0	79	52
Dataset_02	MLP	1	1410	7	100	93
Dataset_02	MLP	2	1	4	7	5
Dataset_02	MLP	3	66	18	119	152
Dataset_02	MLP	4	34	8	41	101
Dataset_02	RNN	1	1318	94	106	92
Dataset_02	RNN	2	1	7	6	3
Dataset_02	RNN	3	48	80	110	117
Dataset_02	RNN	4	26	36	38	84

Dataset_02	LSTM	1	1391	11	125	83
Dataset_02	LSTM	2	2	2	10	3
Dataset_02	LSTM	3	53	29	139	134
Dataset_02	LSTM	4	32	11	46	95
Dataset_02	Transformer	1	1380	9	115	106
Dataset_02	Transformer	2	1	1	13	2
Dataset_02	Transformer	3	56	18	141	140
Dataset_02	Transformer	4	33	6	45	100
Dataset_03	LogisticRegression	1	813	81	49	42
Dataset_03	LogisticRegression	2	1	1	4	6
Dataset_03	LogisticRegression	3	49	49	69	71
Dataset_03	LogisticRegression	4	18	17	21	47
Dataset_03	RandomForest	1	943	0	41	1
Dataset_03	RandomForest	2	3	0	5	4
Dataset_03	RandomForest	3	116	0	101	21
Dataset_03	RandomForest	4	26	0	63	14
Dataset_03	XGBoost	1	924	2	52	7
Dataset_03	XGBoost	2	2	0	6	4
Dataset_03	XGBoost	3	100	0	101	37
Dataset_03	XGBoost	4	28	0	53	22
Dataset_03	MLP	1	879	7	51	48
Dataset_03	MLP	2	1	0	6	5
Dataset_03	MLP	3	75	13	72	78
Dataset_03	MLP	4	21	1	34	47
Dataset_03	RNN	1	824	79	40	42
Dataset_03	RNN	2	1	1	3	7

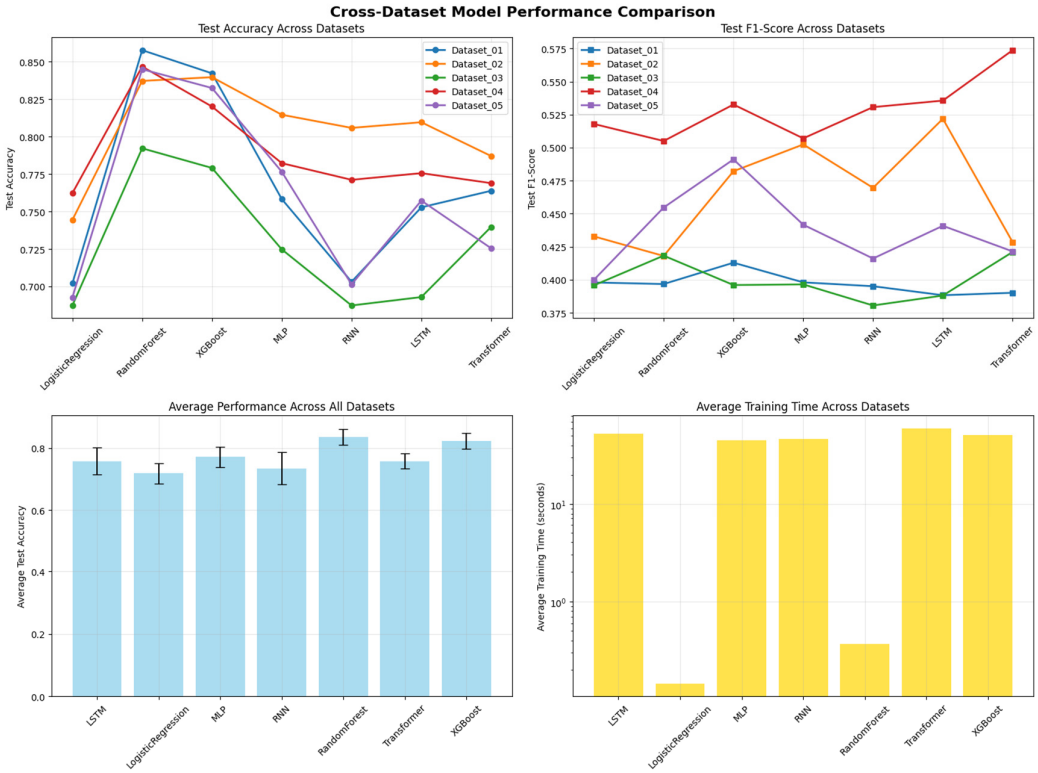
Dataset_03	RNN	3	54	42	68	74
Dataset_03	RNN	4	18	15	21	49
Dataset_03	LSTM	1	833	40	66	46
Dataset_03	LSTM	2	1	0	6	5
Dataset_03	LSTM	3	57	25	87	69
Dataset_03	LSTM	4	17	6	36	44
Dataset_03	Transformer	1	852	20	55	58
Dataset_03	Transformer	2	1	0	4	7
Dataset_03	Transformer	3	60	12	71	95
Dataset_03	Transformer	4	17	2	24	60

Supplementary Table S4. Overall performance statistics for each dataset

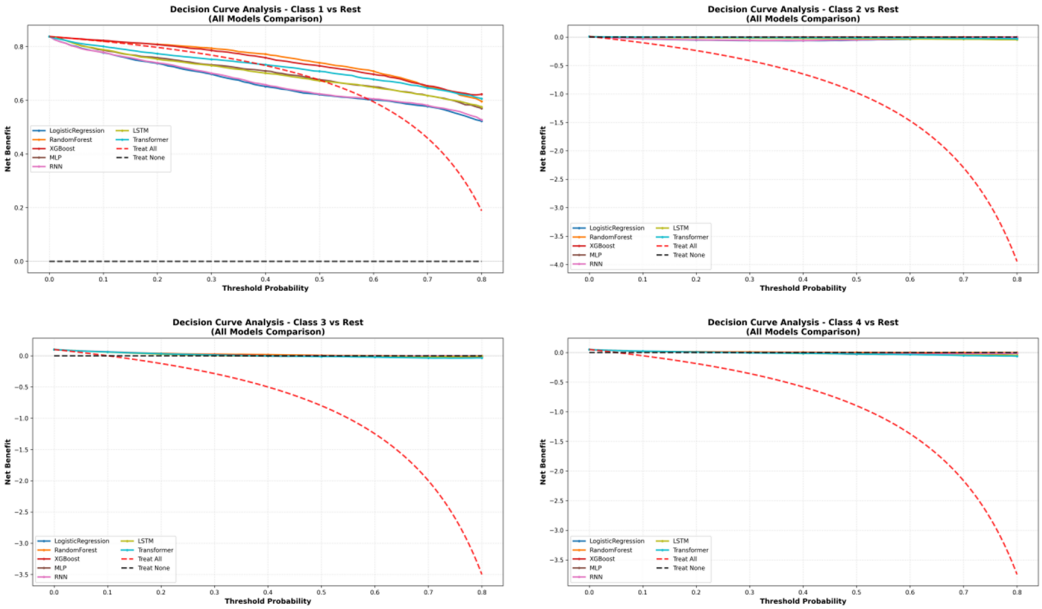
Dataset	Accuracy	Accuracy	Accuracy	Accuracy	F1_Weighted	F1_Weighted	F1_Weighted	F1_Weighted	Precision_Weighted	Precision_Weighted	Recall_Weighted	Recall_Weighted
	mean	std	min	max	mean	std	min	max	mean	std	mean	std
Dataset_01	0.804	0.0506	0.7417	0.8745	0.8256	0.0257	0.7935	0.8605	0.8574	0.0067	0.804	0.0506
Dataset_02	0.7551	0.0471	0.6994	0.8163	0.7704	0.0252	0.7413	0.8079	0.795	0.0056	0.7551	0.0471
Dataset_03	0.7391	0.0368	0.6951	0.7907	0.7492	0.0128	0.7329	0.7666	0.7709	0.0156	0.7391	0.0368



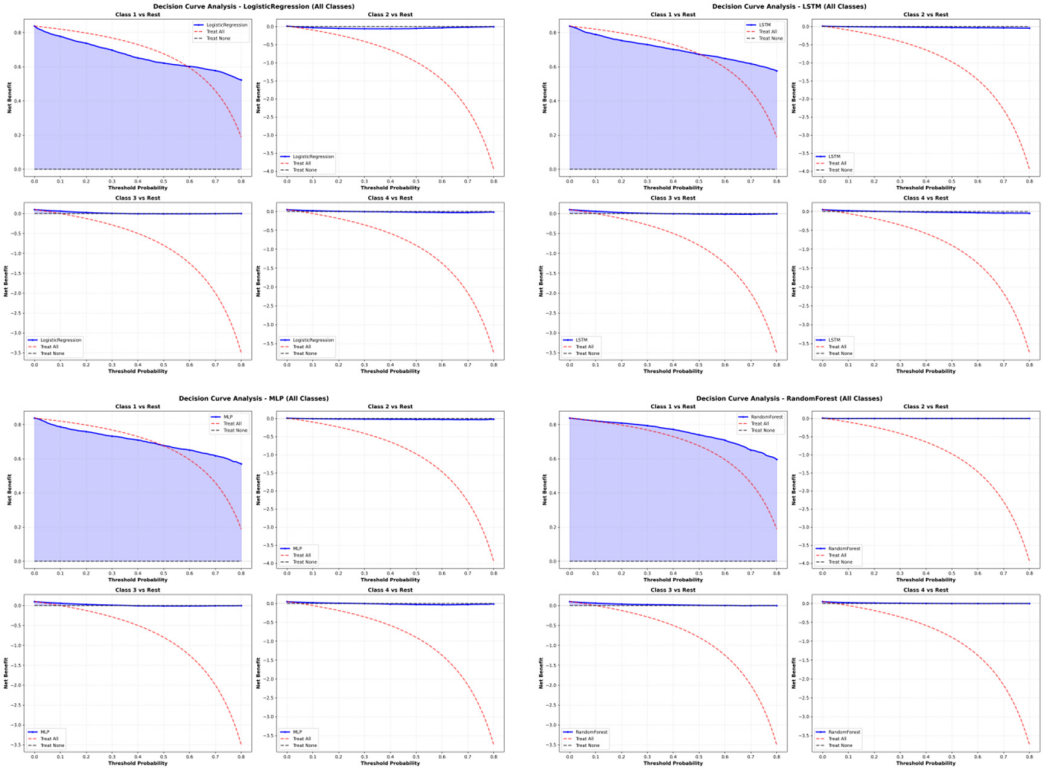
S1. Trajectory Analysis Results (5 classes)

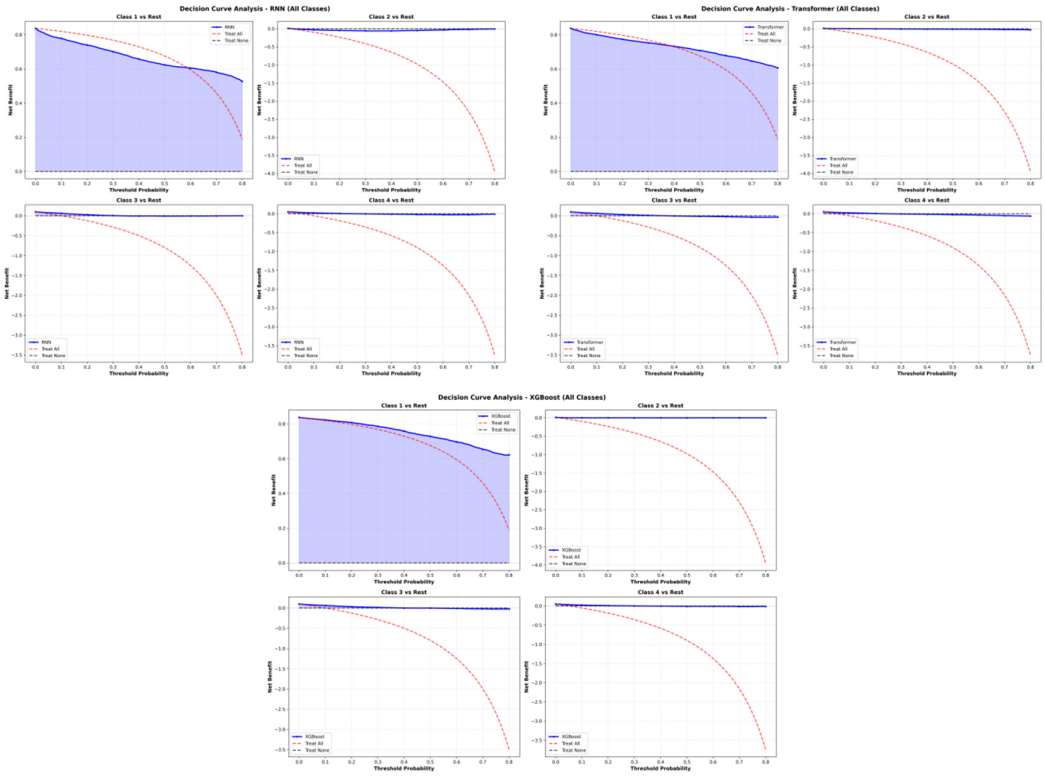


S2. Cross-Dataset Model Performance Comparison



S3-S6.Decision Curve Analysis (DCA) across all outcome classes





S7-S13.Decision Curve Analysis (DCA) across all outcome models

Supplementary Figures S1-S11. Decision Curve Analysis (DCA) across all outcome classes and models