Social media use and depression across 11 years of U.S. adult data

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Supplementary Tables

Table S1 – Interaction terms and Logistic Regression for SMU with SRD given covariates

Interaction	Coefficient	SE	P Value
SMU * age_range	0.000266	3.23E-05	2.08E-16
SMU * gender	0.000282	0.000106	0.008093

Legend: Logistic regression interaction results for SMU on SRD, with the coefficient of regression, standard errors (SE) and p values listed.

Table S2 – Covariate Adjusted Logistic Regressions by Media Type with SRD per Year

Year	Media Variable	Coefficient	SE	P-Value	Odds Ratio	N	P-Value Bonferroni	Bonferroni Signficance
2014	social_media	1.827E-03	2.018E-04	1.388E-19	1.002E+00	15411	9.161E-18	TRUE
2014	gaming	2.264E-03	2.532E-04	3.791E-19	1.002E+00	15411	2.502E-17	TRUE
2014	tvh	1.725E-03	2.243E-04	1.465E-14	1.002E+00	15411	9.666E-13	TRUE
2014	inth	2.148E-03	1.975E-04	1.505E-27	1.002E+00	15411	9.932E-26	TRUE
2014	newh	1.687E-03	4.712E-04	3.430E-04	1.002E+00	15411	2.264E-02	TRUE
2014	emailh	1.537E-03	2.156E-04	1.026E-12	1.002E+00	15411	6.774E-11	TRUE
2015	social_media	2.591E-03	1.825E-04	9.746E-46	1.003E+00	16228	6.432E-44	TRUE
2015	gaming	3.508E-03	2.253E-04	1.167E-54	1.004E+00	16228	7.702E-53	TRUE
2015	tvh	2.872E-03	1.987E-04	2.253E-47	1.003E+00	16228	1.487E-45	TRUE
2015	inth	2.990E-03	1.792E-04	1.739E-62	1.003E+00	16228	1.148E-60	TRUE
2015	newh	3.557E-03	3.784E-04	5.365E-21	1.004E+00	16228	3.541E-19	TRUE
2015	emailh	2.848E-03	1.987E-04	1.426E-46	1.003E+00	16228	9.412E-45	TRUE
2016	social_media	1.713E-03	1.818E-04	4.478E-21	1.002E+00	16121	2.955E-19	TRUE
2016	gaming	2.513E-03	2.948E-04	1.569E-17	1.003E+00	7714	1.036E-15	TRUE
2016	tvh	1.647E-03	2.004E-04	2.074E-16	1.002E+00	16121	1.369E-14	TRUE

2016	inth	2.180E-03	1.793E-04	5.110E-34	1.002E+00	16121	3.373E-32	TRUE
2016	newh	-4.801E-04	3.861E-04	2.136E-01	9.995E-01	16121	1.000E+00	FALSE
2016	emailh	1.515E-03	2.012E-04	5.099E-14	1.002E+00	16121	3.365E-12	TRUE
2017	social_media	2.440E-03	1.710E-04	3.617E-46	1.002E+00	16644	2.388E-44	TRUE
2017	gaming	2.390E-03	2.247E-04	2.010E-26	1.002E+00	16644	1.327E-24	TRUE
2017	tvh	2.094E-03	1.914E-04	7.107E-28	1.002E+00	16644	4.691E-26	TRUE
2017	inth	2.527E-03	1.745E-04	1.662E-47	1.003E+00	16644	1.097E-45	TRUE
2017	newh	3.730E-04	4.512E-04	4.084E-01	1.000E+00	16644	1.000E+00	FALSE
2017	emailh	2.245E-03	1.944E-04	7.476E-31	1.002E+00	16644	4.934E-29	TRUE
2018	social_media	2.052E-03	1.772E-04	5.305E-31	1.002E+00	15770	3.501E-29	TRUE
2018	gaming	2.662E-03	2.342E-04	6.206E-30	1.003E+00	15770	4.096E-28	TRUE
2018	tvh	2.817E-03	2.303E-04	2.110E-34	1.003E+00	15770	1.393E-32	TRUE
2018	inth	2.371E-03	1.807E-04	2.370E-39	1.002E+00	15770	1.564E-37	TRUE
2018	newh	6.667E-04	4.596E-04	1.469E-01	1.001E+00	15770	1.000E+00	FALSE
2018	emailh	2.021E-03	2.049E-04	5.905E-23	1.002E+00	15770	3.897E-21	TRUE
2019	social_media	2.502E-03	1.750E-04	2.201E-46	1.003E+00	16619	1.453E-44	TRUE
2019	gaming	2.910E-03	2.362E-04	7.313E-35	1.003E+00	16619	4.826E-33	TRUE
2019	tvh	2.741E-03	2.105E-04	9.141E-39	1.003E+00	16619	6.033E-37	TRUE
2019	inth	2.814E-03	1.782E-04	3.508E-56	1.003E+00	16619	2.315E-54	TRUE
2019	newh	4.821E-04	4.859E-04	3.212E-01	1.000E+00	16619	1.000E+00	FALSE
2019	emailh	2.253E-03	2.068E-04	1.182E-27	1.002E+00	16619	7.803E-26	TRUE
2020	social_media	2.706E-03	1.679E-04	2.190E-58	1.003E+00	16832	1.445E-56	TRUE
2020	gaming	2.812E-03	2.216E-04	6.762E-37	1.003E+00	16832	4.463E-35	TRUE
2020	tvh	2.335E-03	2.005E-04	2.338E-31	1.002E+00	16832	1.543E-29	TRUE
2020	inth	2.891E-03	1.721E-04	2.412E-63	1.003E+00	16832	1.592E-61	TRUE
2020	newh	7.305E-04	4.308E-04	8.994E-02	1.001E+00	16832	1.000E+00	FALSE
2020	emailh	2.152E-03	2.058E-04	1.324E-25	1.002E+00	16832	8.737E-24	TRUE
2021	social_media	2.913E-03	1.723E-04	4.296E-64	1.003E+00	17056	2.835E-62	TRUE
2021	gaming	3.162E-03	2.286E-04	1.579E-43	1.003E+00	17056	1.042E-41	TRUE
2021	tvh	2.678E-03	1.975E-04	6.949E-42	1.003E+00	17056	4.586E-40	TRUE
2021	inth	2.879E-03	1.726E-04	1.717E-62	1.003E+00	17056	1.133E-60	TRUE
2021	newh	-5.626E-05	4.655E-04	9.038E-01	9.999E-01	17056	1.000E+00	FALSE
2021	emailh	2.394E-03	2.112E-04	8.338E-30	1.002E+00	17056	5.503E-28	TRUE
2022	social_media	3.051E-03	1.723E-04	3.485E-70	1.003E+00	17430	2.300E-68	TRUE
2022	gaming	3.303E-03	2.162E-04	1.093E-52	1.003E+00	17430	7.211E-51	TRUE
2022	tvh	2.407E-03	1.894E-04	5.502E-37	1.002E+00	17430	3.631E-35	TRUE
2022	inth	2.942E-03	1.690E-04	6.636E-68	1.003E+00	17430	4.380E-66	TRUE
2022	newh	6.273E-04	4.373E-04	1.514E-01	1.001E+00	17430	1.000E+00	FALSE
2022	emailh	2.377E-03	2.085E-04	4.259E-30	1.002E+00	17430	2.811E-28	TRUE
2023	social_media	3.194E-03	1.676E-04	5.598E-81	1.003E+00	17519	3.694E-79	TRUE
2023	gaming	3.676E-03	2.174E-04	3.753E-64	1.004E+00	17519	2.477E-62	TRUE
2023	tvh	2.757E-03	1.814E-04	3.633E-52	1.003E+00	17519	2.398E-50	TRUE
2023	inth	3.267E-03	1.687E-04	1.642E-83	1.003E+00	17519	1.084E-81	TRUE
2023	newh	2.594E-04	4.099E-04	5.269E-01	1.000E+00	17519	1.000E+00	FALSE
2023	emailh	2.766E-03	2.088E-04	4.698E-40	1.003E+00	17519	3.101E-38	TRUE
2024	social_media	2.839E-03	1.573E-04	9.169E-73	1.003E+00	17869	6.052E-71	TRUE

2024	gaming	3.426E-03	2.059E-04	3.708E-62	1.003E+00	17869	2.447E-60	TRUE
2024	tvh	2.316E-03	1.764E-04	2.362E-39	1.002E+00	17869	1.559E-37	TRUE
2024	inth	2.901E-03	1.587E-04	1.073E-74	1.003E+00	17869	7.082E-73	TRUE
2024	newh	-1.101E-03	4.062E-04	6.722E-03	9.989E-01	17869	4.437E-01	FALSE
2024	emailh	2.347E-03	1.932E-04	5.968E-34	1.002E+00	17869	3.939E-32	TRUE

Legend – The table above, provides detailed values of parameter estimates for each media type in their association with SRD having controlled for appropriate demographic variables. Social media usage is statistically significant across the entire period of the study 2014-2024 even after multiple testing corrections.

Table S3 – Prediction Metrics

Model	Year	AUROC	Accuracy	Sensitivity	Specificity	Precision	NPV	Brier
Majority Class	2014	0.5	0.849	0	1	0	0.849	0.151
LR (Demographics)	2014	0.635	0.849	0	1	0	0.849	0.125
LR (Demographics + Media)	2014	0.653	0.849	0.005	0.999	0.482	0.85	0.123
BRF (Demographics)	2014	0.639	0.695	0.432	0.742	0.229	0.88	0.198
BRF (Demographics + Media)	2014	0.661	0.749	0.395	0.812	0.272	0.883	0.184
Majority Class	2015	0.5	0.828	0	1	0	0.828	0.172
LR (Demographics)	2015	0.641	0.828	0	1	0	0.828	0.138
LR (Demographics + Media)	2015	0.672	0.832	0.046	0.995	0.646	0.834	0.133
BRF (Demographics)	2015	0.648	0.7	0.456	0.751	0.275	0.869	0.2
BRF (Demographics + Media)	2015	0.681	0.745	0.436	0.81	0.322	0.874	0.184
Majority Class	2016	0.5	0.833	0	1	0	0.833	0.167
LR (Demographics)	2016	0.65	0.833	0	1	0	0.833	0.133
LR (Demographics + Media)	2016	0.668	0.832	0.015	0.996	0.451	0.834	0.131
BRF (Demographics)	2016	0.676	0.725	0.462	0.777	0.294	0.878	0.189
BRF (Demographics + Media)	2016	0.698	0.771	0.414	0.842	0.346	0.878	0.175
Majority Class	2017	0.5	0.822	0	1	0	0.822	0.178
LR (Demographics)	2017	0.638	0.822	0	1	0	0.822	0.142
LR (Demographics + Media)	2017	0.665	0.821	0.016	0.996	0.486	0.823	0.139
BRF (Demographics)	2017	0.649	0.695	0.452	0.748	0.281	0.863	0.2
BRF (Demographics + Media)	2017	0.683	0.747	0.429	0.816	0.336	0.868	0.184
Majority Class	2018	0.5	0.814	0	1	0	0.814	0.186
LR (Demographics)	2018	0.635	0.814	0	1	0.01	0.814	0.146
LR (Demographics + Media)	2018	0.663	0.814	0.018	0.995	0.47	0.816	0.143
BRF (Demographics)	2018	0.643	0.684	0.448	0.738	0.281	0.854	0.204
BRF (Demographics + Media)	2018	0.681	0.745	0.425	0.818	0.348	0.862	0.186

Majority Class	2019	0.5	0.827	0	1	0	0.827	0.173
LR (Demographics)	2019	0.659	0.827	0	1	0	0.827	0.137
LR (Demographics + Media)	2019	0.686	0.827	0.032	0.993	0.507	0.83	0.133
BRF (Demographics)	2019	0.669	0.692	0.495	0.734	0.28	0.874	0.198
BRF (Demographics + Media)	2019	0.702	0.741	0.464	0.799	0.326	0.877	0.181
Majority Class	2020	0.5	0.808	0	1	0	0.808	0.192
LR (Demographics)	2020	0.65	0.808	0	1	0.065	0.808	0.149
LR (Demographics + Media)	2020	0.68	0.808	0.043	0.99	0.518	0.813	0.145
BRF (Demographics)	2020	0.658	0.686	0.471	0.737	0.299	0.854	0.203
BRF (Demographics + Media)	2020	0.69	0.732	0.442	0.801	0.346	0.858	0.187
Majority Class	2021	0.5	0.816	0	1	0	0.816	0.184
LR (Demographics)	2021	0.683	0.816	0.007	0.998	0.416	0.817	0.14
LR (Demographics + Media)	2021	0.708	0.821	0.081	0.988	0.597	0.827	0.135
BRF (Demographics)	2021	0.693	0.702	0.522	0.743	0.314	0.874	0.194
BRF (Demographics + Media)	2021	0.725	0.757	0.506	0.813	0.379	0.88	0.176
Majority Class	2022	0.5	0.806	0	1	0	0.806	0.194
LR (Demographics)	2022	0.692	0.807	0.024	0.995	0.533	0.809	0.144
LR (Demographics + Media)	2022	0.719	0.81	0.096	0.982	0.56	0.819	0.14
BRF (Demographics)	2022	0.709	0.707	0.548	0.746	0.341	0.873	0.191
BRF (Demographics + Media)	2022	0.739	0.749	0.534	0.8	0.391	0.877	0.176
Majority Class	2023	0.5	0.787	0	1	0	0.787	0.213
LR (Demographics)	2023	0.644	0.787	0.001	0.999	0.125	0.787	0.161
LR (Demographics + Media)	2023	0.681	0.79	0.073	0.984	0.549	0.797	0.155
BRF (Demographics)	2023	0.664	0.677	0.502	0.724	0.33	0.843	0.207
BRF (Demographics + Media)	2023	0.703	0.728	0.482	0.795	0.389	0.85	0.189
Majority Class	2024	0.5	0.78	0	1	0	0.78	0.22
LR (Demographics)	2024	0.64	0.78	0.003	0.999	0.403	0.78	0.165
LR (Demographics + Media)	2024	0.676	0.782	0.068	0.984	0.548	0.789	0.16
BRF (Demographics)	2024	0.674	0.686	0.51	0.736	0.353	0.842	0.205
BRF (Demographics + Media)	2024	0.696	0.723	0.472	0.794	0.393	0.842	0.191

Legend – This table provides several metrics across benchmarks and ablations. We report AUROC (discrimination) and the Brier score (probabilistic calibration). Brier scores which are the mean squared error of prediction probabilities provide a complementary assessment beyond AUROC. Logistic regression achieves lower Brier scores, consistent with better calibrated probability estimates even when 0.5 threshold yields low sensitivity under class imbalance. The BRF improves AUROC and sensitivity but exhibits larger Brier scores, which for the tree-models require post-hoc calibration. We interpret the BRF as a primary model for signal stability over time rather than perfectly calibrated risk model.

Table S4 – Importance Comparison Across Procedures And Years

Year	Feature	Gini	Permutation	SHAP	Normalized Gini	Normalized Permutation	Normalized SHAP
2014	inth	0.108	0.036	0.032	1.000	0.625	0.930
2014	tvh	0.104	0.030	0.024	0.964	0.519	0.689
2014	emailh	0.097	0.023	0.015	0.897	0.399	0.428

2014	personal_income	0.093	0.057	0.034	0.860	1.000	1.000
2014	social_media	0.086	0.029	0.024	0.792	0.510	0.692
2014	gaming	0.071	0.026	0.026	0.661	0.452	0.754
2014	newh	0.067	0.016	0.013	0.623	0.278	0.376
2014	occupation	0.067	0.032	0.030	0.622	0.559	0.881
2014	age_range	0.058	0.038	0.029	0.541	0.675	0.837
2014	education_level	0.057	0.028	0.024	0.527	0.496	0.698
2014	household_size	0.045	0.007	0.008	0.420	0.129	0.245
2014	ethnicity	0.044	0.022	0.024	0.408	0.392	0.695
2014	marital_status	0.039	0.031	0.025	0.363	0.552	0.743
2014	under_18_count	0.039	0.015	0.008	0.360	0.264	0.243
2014	gender	0.024	0.010	0.009	0.218	0.174	0.277
2015	inth	0.108	0.039	0.035	1.000	0.815	1.000
2015	tvh	0.105	0.036	0.027	0.969	0.749	0.762
2015	emailh	0.097	0.024	0.016	0.897	0.497	0.457
2015	social_media	0.088	0.034	0.028	0.811	0.709	0.803
2015	personal_income	0.087	0.042	0.030	0.804	0.881	0.846
2015	gaming	0.078	0.034	0.032	0.723	0.720	0.895
2015	occupation	0.072	0.036	0.032	0.664	0.750	0.900
2015	newh	0.066	0.013	0.012	0.611	0.264	0.329
2015	age_range	0.061	0.048	0.031	0.565	1.000	0.876
2015	education_level	0.054	0.022	0.018	0.499	0.460	0.497
2015	ethnicity	0.044	0.019	0.020	0.411	0.406	0.574
2015	household_size	0.042	0.007	0.008	0.385	0.155	0.223
2015	marital_status	0.040	0.036	0.028	0.369	0.746	0.799
2015	under_18_count	0.038	0.016	0.008	0.347	0.342	0.230
2015	gender	0.022	0.024	0.025	0.204	0.502	0.703
2016	inth	0.109	0.049	0.040	1.000	0.859	0.902
2016	tvh	0.104	0.025	0.023	0.953	0.441	0.530
2016	emailh	0.095	0.019	0.014	0.876	0.334	0.326
2016	personal_income	0.089	0.057	0.038	0.820	1.000	0.848
2016	social_media	0.087	0.030	0.026	0.801	0.535	0.583
2016	occupation	0.086	0.041	0.044	0.792	0.726	1.000
2016	gaming	0.071	0.014	0.023	0.657	0.239	0.522
2016	newh	0.062	0.012	0.013	0.571	0.204	0.301
2016	age_range	0.060	0.032	0.030	0.548	0.566	0.687
2016	education_level	0.052	0.014	0.014	0.476	0.249	0.312
2016	household_size	0.044	0.006	0.010	0.403	0.098	0.237
2016	under_18_count	0.040	0.007	0.010	0.370	0.117	0.227
2016	marital_status	0.040	0.036	0.028	0.366	0.637	0.637
2016	ethnicity	0.039	0.008	0.015	0.360	0.145	0.332
2016	gender	0.022	0.009	0.015	0.203	0.159	0.349
2017	inth	0.109	0.038	0.032	1.000	0.577	0.711
2017	tvh	0.107	0.030	0.025	0.981	0.454	0.559
2017	social_media	0.100	0.066	0.045	0.920	1.000	1.000
2017	emailh	0.100	0.017	0.016	0.917	0.263	0.350

2017	personal_income	0.092	0.060	0.041	0.848	0.901	0.920
2017	occupation	0.073	0.036	0.036	0.668	0.545	0.806
2017	gaming	0.069	0.020	0.023	0.635	0.295	0.519
2017	age_range	0.062	0.037	0.032	0.571	0.562	0.719
2017	newh	0.059	0.009	0.010	0.544	0.137	0.233
2017	education_level	0.054	0.016	0.018	0.500	0.235	0.391
2017	household_size	0.044	0.005	0.009	0.399	0.072	0.201
2017	ethnicity	0.038	0.007	0.015	0.351	0.102	0.328
2017	marital_status	0.038	0.019	0.021	0.350	0.291	0.472
2017	under_18_count	0.033	0.003	0.008	0.300	0.050	0.178
2017	gender	0.021	0.008	0.015	0.190	0.114	0.331
2018	tvh	0.111	0.028	0.028	1.000	0.479	0.610
2018	inth	0.110	0.039	0.029	0.997	0.658	0.637
2018	emailh	0.102	0.016	0.016	0.921	0.272	0.341
2018	social_media	0.100	0.043	0.032	0.903	0.737	0.706
2018	personal_income	0.097	0.059	0.046	0.879	1.000	1.000
2018	gaming	0.074	0.024	0.029	0.668	0.412	0.627
2018	occupation	0.069	0.029	0.033	0.624	0.489	0.722
2018	age_range	0.060	0.032	0.032	0.537	0.546	0.701
2018	newh	0.058	0.009	0.013	0.523	0.149	0.290
2018	education_level	0.055	0.010	0.015	0.500	0.163	0.325
2018	household_size	0.044	0.003	0.010	0.400	0.055	0.228
2018	marital_status	0.037	0.015	0.020	0.330	0.256	0.447
2018	ethnicity	0.032	0.002	0.012	0.286	0.039	0.254
2018	under_18_count	0.031	0.002	0.006	0.275	0.028	0.123
2018	gender	0.020	0.019	0.028	0.180	0.324	0.608
2019	inth	0.112	0.050	0.037	1.000	0.727	0.828
2019	tvh	0.104	0.031	0.022	0.922	0.456	0.501
2019	social_media	0.101	0.050	0.037	0.896	0.732	0.829
2019	emailh	0.099	0.023	0.014	0.883	0.327	0.323
2019	personal_income	0.096	0.069	0.043	0.850	1.000	0.975
2019	gaming	0.077	0.036	0.032	0.685	0.529	0.711
2019	occupation	0.065	0.023	0.024	0.575	0.328	0.533
2019	age_range	0.058	0.056	0.045	0.517	0.816	1.000
2019	newh	0.056	0.012	0.012	0.501	0.176	0.262
2019	education_level	0.056	0.031	0.025	0.500	0.455	0.566
2019	household_size	0.045	0.007	0.008	0.399	0.095	0.179
2019	ethnicity	0.040	0.016	0.018	0.353	0.226	0.403
2019	marital_status	0.037	0.023	0.024	0.326	0.338	0.533
2019	under_18_count	0.032	0.014	0.007	0.284	0.197	0.166
2019	gender	0.022	0.017	0.023	0.199	0.241	0.516
2020	inth	0.111	0.044	0.037	1.000	0.770	0.828
2020	social_media	0.105	0.050	0.042	0.948	0.884	0.919
2020	tvh	0.103	0.024	0.019	0.924	0.424	0.426
2020	emailh	0.098	0.016	0.014	0.880	0.285	0.315
2020	personal_income	0.093	0.057	0.041	0.836	1.000	0.911

2020	gaming	0.081	0.029	0.031	0.733	0.504	0.681
2020	occupation	0.067	0.030	0.032	0.604	0.531	0.718
2020	age_range	0.060	0.049	0.045	0.542	0.869	1.000
2020	newh	0.057	0.008	0.010	0.509	0.147	0.229
2020	education_level	0.055	0.014	0.017	0.496	0.242	0.366
2020	household_size	0.044	0.005	0.010	0.394	0.085	0.217
2020	marital_status	0.038	0.027	0.028	0.346	0.471	0.619
2020	ethnicity	0.036	0.009	0.017	0.325	0.166	0.372
2020	under_18_count	0.030	0.003	0.005	0.274	0.046	0.121
2020	gender	0.021	0.005	0.015	0.187	0.085	0.322
2021	social_media	0.103	0.051	0.043	1.000	0.675	0.813
2021	inth	0.103	0.033	0.027	0.999	0.446	0.520
2021	personal_income	0.101	0.075	0.053	0.987	1.000	1.000
2021	tvh	0.099	0.026	0.020	0.968	0.346	0.379
2021	emailh	0.095	0.021	0.015	0.923	0.281	0.289
2021	gaming	0.077	0.024	0.026	0.747	0.317	0.494
2021	age_range	0.069	0.051	0.043	0.672	0.675	0.825
2021	occupation	0.063	0.028	0.029	0.614	0.378	0.552
2021	education_level	0.059	0.047	0.037	0.577	0.624	0.707
2021	newh	0.055	0.014	0.012	0.540	0.186	0.221
2021	household_size	0.042	0.006	0.008	0.414	0.086	0.148
2021	ethnicity	0.040	0.013	0.017	0.389	0.172	0.319
2021	marital_status	0.040	0.024	0.030	0.388	0.326	0.566
2021	under_18_count	0.032	0.005	0.007	0.314	0.064	0.142
2021	gender	0.022	0.018	0.024	0.210	0.244	0.463
2022	personal_income	0.101	0.077	0.056	1.000	1.000	1.000
2022	inth	0.099	0.030	0.028	0.978	0.387	0.489
2022	social_media	0.098	0.044	0.040	0.968	0.578	0.710
2022	tvh	0.097	0.024	0.019	0.956	0.319	0.331
2022	emailh	0.090	0.020	0.014	0.889	0.264	0.243
2022	gaming	0.078	0.030	0.032	0.770	0.390	0.571
2022	age_range	0.075	0.067	0.053	0.738	0.870	0.937
2022	occupation	0.069	0.036	0.036	0.680	0.466	0.646
2022	education_level	0.060	0.033	0.032	0.592	0.434	0.571
2022	newh	0.054	0.009	0.009	0.530	0.121	0.163
2022	household_size	0.043	0.007	0.009	0.423	0.091	0.165
2022	ethnicity	0.040	0.011	0.015	0.395	0.140	0.267
2022	marital_status	0.039	0.015	0.021	0.387	0.200	0.367
2022	under_18_count	0.033	0.006	0.008	0.323	0.082	0.142
2022	gender	0.024	0.034	0.035	0.236	0.448	0.629
2023	inth	0.103	0.031	0.028	1.000	0.503	0.616
2023	tvh	0.100	0.028	0.023	0.974	0.446	0.496
2023	social_media	0.099	0.039	0.035	0.965	0.626	0.767
2023	emailh	0.092	0.021	0.016	0.895	0.333	0.342
2023	personal_income	0.091	0.058	0.041	0.890	0.925	0.878
2023	gaming	0.082	0.029	0.031	0.798	0.463	0.677

2023	age_range	0.070	0.063	0.046	0.681	1.000	1.000
2023	occupation	0.065	0.025	0.028	0.632	0.407	0.598
2023	newh	0.060	0.011	0.011	0.581	0.175	0.243
2023	education_level	0.056	0.029	0.026	0.545	0.457	0.553
2023	household_size	0.046	0.005	0.008	0.447	0.080	0.177
2023	marital_status	0.040	0.012	0.017	0.394	0.197	0.374
2023	ethnicity	0.039	0.011	0.018	0.384	0.173	0.381
2023	under_18_count	0.035	0.005	0.008	0.339	0.076	0.164
2023	gender	0.021	0.038	0.035	0.208	0.607	0.765
2024	inth	0.102	0.024	0.025	1.000	0.381	0.585
2024	tvh	0.101	0.024	0.019	0.994	0.386	0.449
2024	social_media	0.101	0.041	0.036	0.991	0.657	0.826
2024	emailh	0.095	0.016	0.015	0.935	0.256	0.348
2024	personal_income	0.093	0.063	0.043	0.913	1.000	1.000
2024	gaming	0.082	0.029	0.033	0.811	0.456	0.764
2024	age_range	0.065	0.051	0.042	0.639	0.819	0.964
2024	occupation	0.065	0.025	0.027	0.639	0.397	0.626
2024	newh	0.059	0.009	0.013	0.576	0.144	0.297
2024	education_level	0.056	0.021	0.022	0.551	0.330	0.512
2024	household_size	0.046	0.003	0.009	0.452	0.055	0.196
2024	marital_status	0.041	0.013	0.019	0.405	0.209	0.439
2024	ethnicity	0.041	0.012	0.022	0.404	0.192	0.505
2024	under_18_count	0.032	0.002	0.007	0.310	0.034	0.171
2024	gender	0.022	0.043	0.037	0.213	0.680	0.855

Legend – The table above provides relative importance ranks across features for the representative year 2022. We find the social media use variable consistently ranks among the top features regardless of the importance procedure employed.

Table S5 – Covid Sensitivity Analyses

Model	AUROC	Sensitivity
BRF (Excluding COVID)	0.710282	0.465245
LR (with Covid indicator)	0.677238	0.035664
LR (with SMU * Covid)	0.677248	0.036198

Legend: Baseline results with AUROC and Sensitivity metrics for three models: BRF without COVID, Logistic Regression (LR) with COVID and LR with SMU plus COVID.

Table S6 – Prediction Model Metrics for Age Stratified Analysis

Model	AUROC	Accuracy	Sensitivity	Specificity	Precision	NPV	Brier	Year	Age Group	N	SRD Prevalence
BRF (18-25)	0.619	0.695	0.346	0.789	0.305	0.82	0.21	2014	18-25	3070	0.212
BRF (26-44)	0.643	0.743	0.360	0.815	0.267	0.87	0.19	2014	26-44	5078	0.157
BRF (45+)	0.645	0.765	0.390	0.817	0.226	0.91	0.18	2014	45+	7263	0.121
BRF (18-25)	0.630	0.668	0.428	0.736	0.313	0.82	0.21	2015	18-25	3212	0.219
BRF (26-44)	0.667	0.742	0.427	0.815	0.351	0.86	0.19	2015	26-44	5343	0.190
BRF (45+)	0.676	0.761	0.409	0.818	0.267	0.9	0.18	2015	45+	7673	0.139
BRF (18-25)	0.624	0.708	0.375	0.799	0.340	0.82	0.2	2016	18-25	2364	0.216
BRF (26-44)	0.686	0.768	0.416	0.851	0.399	0.86	0.18	2016	26-44	5958	0.192
BRF (45+)	0.690	0.782	0.413	0.839	0.284	0.9	0.17	2016	45+	7799	0.134
BRF (18-25)	0.612	0.695	0.363	0.791	0.334	0.81	0.21	2017	18-25	2086	0.224
BRF (26-44)	0.650	0.722	0.406	0.801	0.337	0.84	0.2	2017	26-44	5662	0.200
BRF (45+)	0.698	0.765	0.435	0.825	0.312	0.89	0.17	2017	45+	8896	0.154
BRF (18-25)	0.625	0.685	0.393	0.781	0.373	0.8	0.21	2018	18-25	1464	0.247
BRF (26-44)	0.635	0.716	0.373	0.803	0.324	0.84	0.2	2018	26-44	5570	0.202
BRF (45+)	0.689	0.764	0.416	0.833	0.331	0.88	0.18	2018	45+	8736	0.165
BRF (18-25)	0.619	0.657	0.402	0.750	0.370	0.77	0.22	2019	18-25	2673	0.267
BRF (26-44)	0.679	0.738	0.430	0.807	0.336	0.86	0.19	2019	26-44	8346	0.185
BRF (45+)	0.683	0.777	0.392	0.825	0.219	0.92	0.17	2019	45+	5600	0.111
BRF (18-25)	0.629	0.658	0.402	0.756	0.390	0.77	0.22	2020	18-25	2497	0.278
BRF (26-44)	0.664	0.710	0.418	0.792	0.362	0.83	0.2	2020	26-44	5371	0.220
BRF (45+)	0.681	0.756	0.415	0.817	0.289	0.89	0.18	2020	45+	8964	0.152
BRF (18-25)	0.678	0.674	0.494	0.755	0.475	0.77	0.21	2021	18-25	2356	0.309
BRF (26-44)	0.715	0.751	0.515	0.805	0.381	0.88	0.18	2021	26-44	6215	0.189
BRF (45+)	0.700	0.772	0.434	0.830	0.302	0.9	0.17	2021	45+	8485	0.145
BRF (18-25)	0.709	0.689	0.540	0.755	0.499	0.79	0.2	2022	18-25	2251	0.310
BRF (26-44)	0.698	0.712	0.498	0.771	0.378	0.85	0.19	2022	26-44	5953	0.218
BRF (45+)	0.722	0.778	0.470	0.833	0.331	0.9	0.17	2022	45+	9226	0.149
BRF (18-25)	0.660	0.694	0.457	0.771	0.393	0.81	0.2	2023	18-25	2178	0.245
BRF (26-44)	0.679	0.703	0.475	0.776	0.403	0.82	0.2	2023	26-44	6293	0.241
BRF (45+)	0.697	0.744	0.455	0.810	0.353	0.87	0.18	2023	45+	9048	0.185
BRF (18-25)	0.671	0.688	0.461	0.768	0.413	0.8	0.2	2024	18-25	2219	0.260
BRF (26-44)	0.676	0.695	0.460	0.774	0.405	0.81	0.2	2024	26-44	6090	0.251
BRF (45+)	0.687	0.741	0.432	0.814	0.356	0.86	0.19	2024	45+	9560	0.192

Legend – This Excel table (double click table cell to scroll) provides age stratified summary metrics regarding performance and prevalence.

Table S7 – Gender Stratified Model Performance

Model	AUROC	Accuracy	Sensitivity	Specificity	Precision	NPV	Brier	Year	N	SRD Prevalence
BRF (Men)	0.666	0.750	0.402	0.809	0.266	0.888	0.183	2014	7329	0.147
BRF (Women)	0.660	0.743	0.407	0.805	0.276	0.881	0.186	2014	8082	0.155
BRF (Young Men (18-25))	0.594	0.710	0.317	0.793	0.244	0.847	0.203	2014	1359	0.173

BRF (Young Women (18-25))	0.613	0.669	0.351	0.771	0.330	0.788	0.213	2014	1710	0.243
BRF (Men)	0.677	0.752	0.413	0.812	0.278	0.888	0.180	2015	7982	0.149
BRF (Women)	0.672	0.725	0.440	0.794	0.339	0.855	0.191	2015	8246	0.194
BRF (Young Men (18-25))	0.615	0.705	0.398	0.760	0.225	0.878	0.198	2015	1607	0.150
BRF (Young Women (18-25))	0.562	0.620	0.374	0.720	0.354	0.739	0.233	2015	1605	0.289
BRF (Men)	0.688	0.782	0.386	0.852	0.318	0.886	0.172	2016	7821	0.151
BRF (Women)	0.697	0.750	0.439	0.819	0.352	0.868	0.180	2016	8300	0.182
BRF (Young Men (18-25))	0.568	0.722	0.306	0.798	0.218	0.863	0.200	2016	1230	0.154
BRF (Young Women (18-25))	0.608	0.665	0.398	0.770	0.406	0.765	0.221	2016	1134	0.282
BRF (Men)	0.666	0.753	0.389	0.821	0.288	0.878	0.183	2017	8132	0.157
BRF (Women)	0.685	0.728	0.454	0.796	0.357	0.854	0.189	2017	8512	0.199
BRF (Young Men (18-25))	0.579	0.735	0.300	0.825	0.266	0.850	0.203	2017	1061	0.172
BRF (Young Women (18-25))	0.576	0.645	0.368	0.752	0.365	0.756	0.227	2017	1025	0.278
BRF (Men)	0.667	0.751	0.391	0.815	0.273	0.883	0.181	2018	7508	0.151
BRF (Women)	0.668	0.724	0.424	0.807	0.380	0.834	0.195	2018	8262	0.218
BRF (Young Men (18-25))	0.570	0.712	0.256	0.795	0.189	0.853	0.201	2018	515	0.155
BRF (Young Women (18-25))	0.594	0.642	0.399	0.744	0.398	0.746	0.226	2018	949	0.297
BRF (Men)	0.683	0.749	0.428	0.803	0.268	0.893	0.180	2019	8084	0.144
BRF (Women)	0.702	0.725	0.488	0.785	0.364	0.859	0.187	2019	8535	0.201
BRF (Young Men (18-25))	0.548	0.641	0.314	0.731	0.245	0.794	0.221	2019	1096	0.217
BRF (Young Women (18-25))	0.634	0.641	0.462	0.719	0.417	0.755	0.221	2019	1577	0.302
BRF (Men)	0.669	0.735	0.405	0.803	0.298	0.867	0.187	2020	8188	0.171
BRF (Women)	0.698	0.722	0.466	0.791	0.375	0.846	0.189	2020	8644	0.212
BRF (Young Men (18-25))	0.589	0.682	0.321	0.783	0.294	0.806	0.211	2020	1278	0.218
BRF (Young Women (18-25))	0.612	0.614	0.428	0.710	0.435	0.705	0.231	2020	1219	0.342
BRF (Men)	0.676	0.753	0.414	0.810	0.268	0.892	0.179	2021	8291	0.143
BRF (Women)	0.737	0.741	0.557	0.793	0.434	0.863	0.181	2021	8765	0.222
BRF (Young Men (18-25))	0.606	0.688	0.362	0.783	0.332	0.808	0.211	2021	1020	0.226
BRF (Young Women (18-25))	0.673	0.638	0.534	0.699	0.513	0.718	0.221	2021	1336	0.371
BRF (Men)	0.715	0.754	0.497	0.799	0.300	0.902	0.174	2022	8479	0.148
BRF (Women)	0.739	0.731	0.555	0.786	0.447	0.851	0.183	2022	8951	0.237
BRF (Young Men (18-25))	0.632	0.697	0.391	0.773	0.297	0.838	0.204	2022	1006	0.198
BRF (Young Women (18-25))	0.694	0.646	0.595	0.680	0.556	0.716	0.218	2022	1245	0.401
BRF (Men)	0.680	0.743	0.434	0.806	0.313	0.875	0.185	2023	8590	0.169
BRF (Women)	0.697	0.706	0.497	0.777	0.433	0.818	0.198	2023	8929	0.255
BRF (Young Men (18-25))	0.640	0.707	0.388	0.784	0.304	0.841	0.199	2023	1016	0.195
BRF (Young Women (18-25))	0.662	0.672	0.499	0.741	0.442	0.785	0.212	2023	1162	0.289
BRF (Men)	0.673	0.748	0.422	0.818	0.330	0.869	0.186	2024	8522	0.176
BRF (Women)	0.687	0.696	0.473	0.775	0.426	0.806	0.201	2024	9347	0.261
BRF (Young Men (18-25))	0.630	0.724	0.372	0.801	0.291	0.854	0.194	2024	1027	0.179
BRF (Young Women (18-25))	0.632	0.642	0.452	0.736	0.459	0.732	0.226	2024	1192	0.331

Legend - This Excel table (double click table cell to scroll) provides gender stratified summary metrics regarding performance and prevalence.

Supplementary SHAP Analysis Description

In Figure 4B the bars represent the SHAP value of each specific feature ordered by their magnitude. The horizontal axis is on the scale of the Shapely value. The Shapley value is the average of the marginal contributions of each feature with that feature removed for all other combinations to assess that features contribution if it were alone. SHAP value analysis is a game-theoretic approach to feature contributions. This approach originated from cooperative game theory and is a robust approach to feature attribution. In our framework, we can canonically represent the contribution of each feature i to the prediction function $f(x)$ through the Shapley value of the feature ϕ_i.

The prediction function (the balanced Random Forest classifier in our study) is a function $f(S) = P(y = c \mid x_S)$, where y is the target class of interest, in this case being depressed or not depressed given the set of features x_S, a subset of the total features N. As the balanced random forest classifier ensures equal representation of classes during training, the conditional probabilities used in the marginalization process are appropriately adjusted. Therefore, for a given subset of features x_S, the expectation is taken over the conditional distribution $P(x_{N\setminus S})$ derived from the data. The SHAP library provides both Monte-Carlo sampling and tree-based approximation approaches to compute the conditional expectations. For the purposes of this study, both provided very similar results and hence only the Monte-Carlo sampling approach in which samples values of $x_{N\setminus S}$ based on the training data were considered.

Given the marginalized distribution, the Shapley value ϕ_i is computed as the following,

$$\phi_i = \sum_{S \subseteq N\setminus i} \frac{|S|!\,(|N| - |S| - 1)!}{|N|!}[f(S \cup i) - f(S)], \qquad (Supplementary\ Eq.\ 1)$$

Where $S \subseteq N\setminus i$ represents the subset of features excluding feature i and $f(S)$ is the marginal probability of the output of the random forest for subset S.

SHAP values ϕ_i for the balanced random forest classifier can be interpreted as the contribution of feature i to the predicted probability of the target class of depressed or not depressed, relative to the balanced distribution of the classes in the training dataset. Positive values indicate the probability of the class increases while the negative value indicates a decrease. The balanced nature of the random forest affects the conditional probability $P(x_{N\setminus S})$ and therefore the resultant Shapley values, which are critical in distinguishing the minority class. By

incorporating the unique characteristics of balanced random forests into the attribution process, this methodology provided robust and interpretable insights into the prediction behavior of the classifier.

We selected SHAP, a Shapley-based method, over other interpretability approaches (e.g., LIME) because SHAP is theoretically grounded in cooperative game theory, can explain both individual and global model behavior, and conveniently handles correlated features. Further specifications used in this analysis included:

- **Explainer:** TreeExplainer (optimized for tree-based models)
- **Background Dataset:** Random sample of 100 training instances per fold for computational efficiency
- **Class:** SHAP values computed for positive class (SRD=1, depression)
- **Aggregation:** Mean absolute SHAP value across all test-set predictions used for feature importance ranking