

Supplementary material

Table S1. Characteristics of the genetic instruments associated with exposure

Figure S1. Scatter plot of SNPs effect sizes with MR-PRESSO outlier removed

Figure S2. Leave-one-out analysis with MR-PRESSO outlier removed

rs11700249	BTBD3	G	T	0.009	0.002	0.409	5.90E-09	4.30E-05	18.834
rs11714337	FOXP1	A	G	-0.010	0.002	0.430	7.60E-10	4.82E-05	21.098
rs11877758	CELF4	G	T	0.011	0.002	0.313	1.30E-10	5.27E-05	23.081
rs11938781	LCORL	C	T	0.013	0.002	0.166	2.00E-09	4.58E-05	20.059
rs12045585	AKT3	A	G	-0.015	0.002	0.131	4.10E-10	5.17E-05	22.651
rs12192804	RP11	C	A	-0.016	0.003	0.095	4.70E-09	4.35E-05	19.039
rs12725934	DPYD	A	T	-0.012	0.002	0.261	3.20E-10	5.20E-05	22.778
rs1291871	CELF2	C	T	0.009	0.002	0.514	9.90E-09	4.19E-05	18.366
rs13014947	PCGEM1	A	G	0.011	0.002	0.575	6.50E-11	5.50E-05	24.085
rs13107325	SLC39A8	T	C	0.020	0.003	0.075	1.70E-11	5.74E-05	25.118
rs1324491	CYP2J2	A	G	0.013	0.002	0.131	1.30E-08	4.10E-05	17.934
rs1451533	LINC01158	A	G	0.010	0.002	0.274	4.40E-08	3.84E-05	16.823
rs147067	DIAPH3	A	G	0.010	0.002	0.755	2.10E-08	4.00E-05	17.502
rs1563908	NDUFAB2	G	A	-0.010	0.002	0.378	4.00E-10	4.96E-05	21.706
rs1727332	C12orf65	T	C	0.013	0.002	0.754	1.10E-12	6.42E-05	28.128
rs1730858	PRMT6	C	T	-0.009	0.002	0.651	2.90E-08	3.97E-05	17.386
rs17789218	RP3	C	T	-0.011	0.002	0.244	3.60E-09	4.40E-05	19.248
rs178203	NOVA1	C	T	0.012	0.002	0.750	5.90E-11	5.42E-05	23.731
rs1826510	CTD	A	G	-0.013	0.002	0.828	1.90E-08	4.61E-05	20.178
rs204092	MACROD2	C	T	-0.010	0.002	0.624	9.00E-09	4.26E-05	18.634
rs2073869	SPACA9	T	C	-0.014	0.002	0.167	1.10E-10	5.29E-05	23.161
rs2106164	RN7SL7P	C	T	-0.009	0.002	0.532	4.20E-09	4.39E-05	19.225
rs2185490	GALNT16	C	A	0.009	0.002	0.618	1.20E-08	4.15E-05	18.169
rs2240857	GLCCI1	G	T	0.016	0.002	0.141	4.50E-12	6.15E-05	26.926
rs2283	EFNA5	G	A	-0.009	0.002	0.339	3.20E-08	3.85E-05	16.870
rs2352984	MON1A	C	T	0.020	0.002	0.431	7.40E-35	1.91E-04	83.848
rs2479968	TEX29	G	A	0.021	0.004	0.051	2.70E-08	4.11E-05	18.008
rs249960	CTD	G	A	-0.012	0.002	0.182	1.10E-08	4.15E-05	18.177
rs2608990	DOCK3	T	C	0.016	0.002	0.126	2.50E-11	5.62E-05	24.619
rs262890	AC010376.1	G	A	0.013	0.002	0.299	2.60E-14	7.35E-05	32.176
rs263771	ZNF804A	A	C	0.012	0.002	0.233	1.90E-10	5.17E-05	22.621
rs2646351	RP11	A	G	0.009	0.002	0.453	2.40E-08	3.94E-05	17.244
rs2678662	AC013727.1	G	T	0.011	0.002	0.608	8.6E-12	5.92E-05	25.924
rs2725371	PURG	G	A	-0.013	0.002	0.696	2.1E-14	7.45E-05	32.628
rs2857693	PRRC2A	T	G	0.011	0.002	0.366	9.60E-11	5.27E-05	23.072
rs3138499	GADD45G	C	A	0.011	0.002	0.518	8.50E-12	6.00E-05	26.285
rs319068	RP11	C	T	-0.009	0.002	0.549	2.60E-08	3.93E-05	17.192
rs34094119	NA	G	A	0.009	0.002	0.525	1.30E-08	4.11E-05	18.014
rs34109383	RP11	T	C	0.010	0.002	0.327	8.00E-09	4.21E-05	18.436
rs34811474	ANAPC4	A	G	-0.013	0.002	0.231	3.10E-12	6.14E-05	26.904
rs34819186	TSNARE1	C	A	0.009	0.002	0.473	3.30E-08	3.88E-05	17.003
rs34864022	LINC01239	G	A	0.021	0.003	0.065	4.60E-11	5.53E-05	24.212
rs35797019	RNU6-461P	G	A	-0.009	0.002	0.392	1.5E-08	4.05E-05	17.728
rs362312	HTT	C	T	-0.010	0.002	0.424	3.5E-09	4.43E-05	19.405
rs3754970	TANK	C	T	0.010	0.002	0.503	1.3E-09	4.71E-05	20.607
rs38004	GLCCI1	T	C	-0.009	0.002	0.456	6.8E-09	4.25E-05	18.628

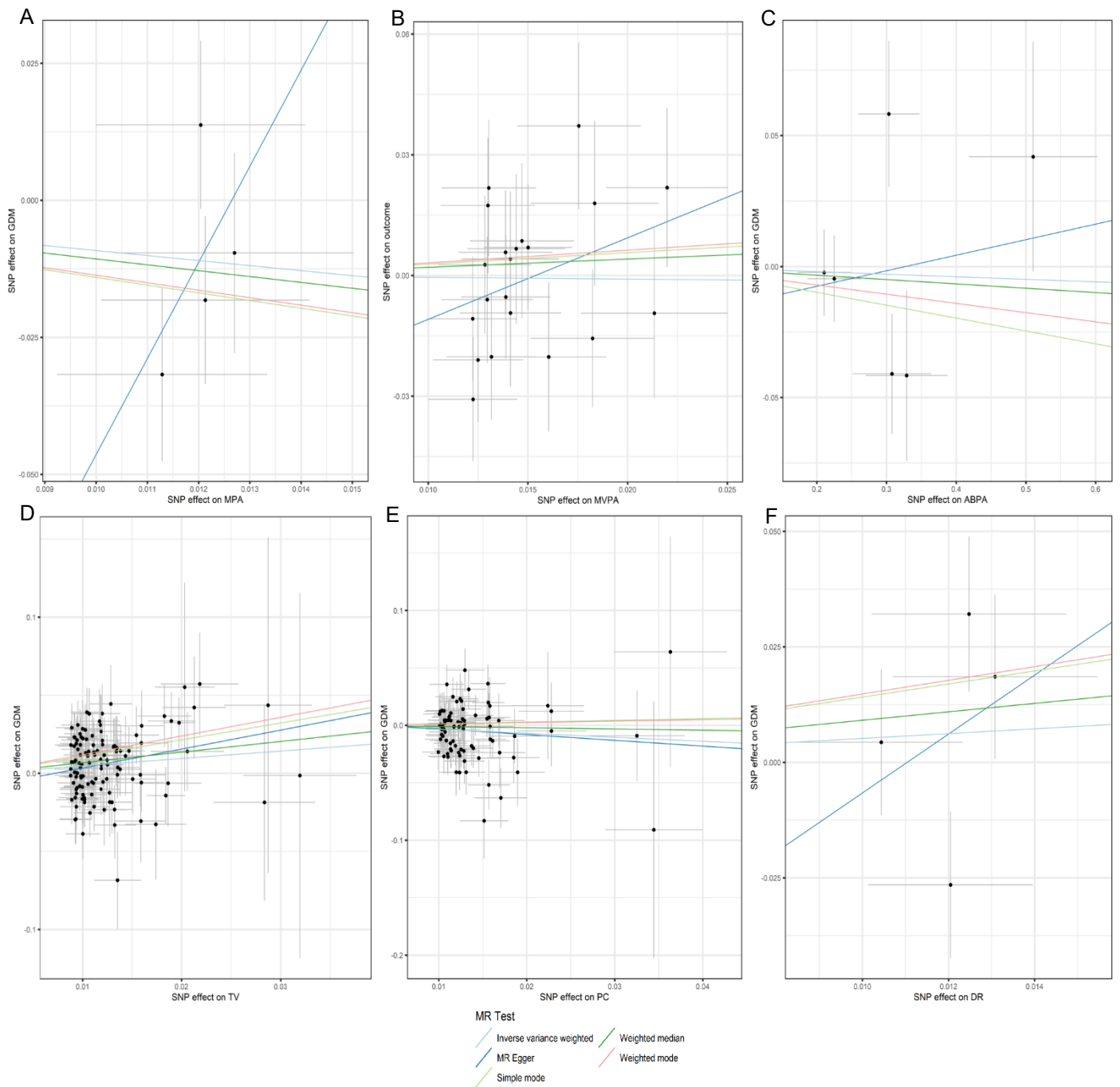
rs3810496	ZBTB46	C	T	0.009	0.002	0.616	1.2E-08	4.15E-05	18.190
rs4076457	LINGO1	T	C	-0.010	0.002	0.257	3.7E-08	3.85E-05	16.848
rs4110177	CTD	A	G	0.009	0.002	0.367	1.3E-08	4.13E-05	18.088
rs4303732	LINC01104	C	T	-0.011	0.002	0.402	3.7E-11	5.53E-05	24.223
rs4339469	RP11	G	T	0.013	0.002	0.629	2.8E-14	7.32E-05	32.075
rs44205	OVOL1	A	G	-0.009	0.002	0.331	2.9E-08	3.88E-05	16.989
rs4469687	EDEM3	G	A	0.009	0.002	0.484	3.1E-08	3.87E-05	16.933
rs4554203	HTR4	A	G	-0.010	0.002	0.420	9.9E-10	4.73E-05	20.718
rs4675246	RP11	T	G	0.012	0.002	0.200	2.1E-09	4.51E-05	19.736
rs4688759	RBM6	C	T	-0.016	0.003	0.106	8.1E-10	4.77E-05	20.884
rs4740589	RNA5SP279	G	A	-0.009	0.002	0.348	3.2E-08	4.07E-05	17.831
rs4747438	DNAJC1	T	C	-0.012	0.002	0.677	3.9E-12	6.11E-05	26.776
rs4788616	PMFBP1	G	T	-0.010	0.002	0.391	4.3E-10	4.94E-05	21.628
rs4911257	DNMT3B	C	T	0.010	0.002	0.393	2.3E-09	4.53E-05	19.857
rs494566	RP11	T	C	0.010	0.002	0.332	2E-09	4.58E-05	20.075
rs507021	DMRTA1	T	C	0.009	0.002	0.571	4.3E-08	3.80E-05	16.661
rs56398417	HSPE1P19	T	C	-0.010	0.002	0.311	1.3E-08	4.09E-05	17.907
rs60737686	HSPE1P19	G	A	-0.012	0.002	0.156	3E-08	3.93E-05	17.217
rs6102912	PTPRT	C	T	-0.011	0.002	0.410	1.4E-11	5.76E-05	25.212
rs61743199	NA	G	A	0.017	0.003	0.072	1.6E-08	4.03E-05	17.648
rs61864793	HMGN2P8	C	T	-0.011	0.002	0.252	1.2E-09	4.68E-05	20.477
rs62145951	PNO1	C	T	-0.012	0.002	0.263	2.6E-11	5.61E-05	24.552
rs62199883	VWC2L	A	C	0.014	0.002	0.486	3.2E-18	9.57E-05	41.925
rs6511708	ILF3	C	T	-0.012	0.002	0.665	7.5E-13	6.51E-05	28.491
rs6740081	DPP10	C	T	0.011	0.002	0.711	2.1E-09	4.54E-05	19.893
rs68056254	AC062032.1	T	G	0.013	0.002	0.151	1.3E-09	4.67E-05	20.434
rs6814554	FAM160A1	A	G	0.014	0.002	0.474	2.4E-17	9.13E-05	39.964
rs6850494	RP11	C	A	0.010	0.002	0.386	3.4E-09	4.42E-05	19.370
rs6876982	RP11	T	C	-0.010	0.002	0.255	4.3E-08	3.80E-05	16.644
rs6895658	LMNB1	C	T	-0.013	0.002	0.193	1.1E-10	5.25E-05	23.009
rs6920115	LINC00240	C	T	-0.018	0.003	0.093	2.2E-11	5.65E-05	24.752
rs6929983	TTBK1	T	C	0.012	0.002	0.166	2.7E-08	3.92E-05	17.147
rs6994132	RP11	C	T	-0.010	0.002	0.579	6.2E-10	4.84E-05	21.188
rs7089973	TAF9BP2	A	C	0.009	0.002	0.380	1.6E-08	4.07E-05	17.831
rs72768080	WDR64	C	T	-0.012	0.002	0.210	2.1E-09	4.69E-05	20.556
rs727809	CTB	C	A	-0.009	0.002	0.431	6.9E-09	4.27E-05	18.681
rs73077107	BSN	A	G	-0.019	0.002	0.125	2.4E-15	7.90E-05	34.612
rs73560982	RP1	C	T	-0.019	0.003	0.060	2.5E-08	3.92E-05	17.183
rs73571431	CRB2	T	C	0.016	0.003	0.110	5.5E-10	4.90E-05	21.469
rs73946726	RP11	A	C	0.032	0.006	0.020	2.2E-08	4.05E-05	17.739
rs7414210	DPYD	C	A	0.013	0.002	0.161	4.4E-09	4.40E-05	19.289
rs749056	CYB561D1	G	T	-0.010	0.002	0.304	7.2E-09	4.25E-05	18.615
rs749671	ZNF646	A	G	-0.011	0.002	0.372	1.6E-11	5.74E-05	25.119
rs7539775	PRDM16	A	G	0.010	0.002	0.743	4.3E-08	3.79E-05	16.602
rs75499503	ZFP57	T	C	-0.018	0.002	0.220	3.1E-21	1.16E-04	50.990
rs75641275	DPYD	C	A	0.015	0.002	0.143	1E-11	5.85E-05	25.614

	rs76608582	CTB	A	C	-0.022	0.004	0.047	3.4E-08	4.26E-05	18.638
	rs77779142	SNX32	T	C	0.012	0.002	0.166	2.6E-08	3.91E-05	17.129
	rs7798292	RP11	A	G	-0.010	0.002	0.435	1.3E-09	4.64E-05	20.340
	rs78227853	FRMD5	T	C	-0.028	0.005	0.025	3.4E-08	3.89E-05	17.028
	rs7899206	RPS27P18	G	T	-0.010	0.002	0.492	1.3E-09	4.78E-05	20.919
	rs7921305	PPP2R2D	A	G	-0.011	0.002	0.253	3.7E-10	4.97E-05	21.762
	rs79373894	NEO1	C	T	-0.029	0.004	0.034	9.8E-11	5.48E-05	23.999
	rs801733	PACS1	C	A	-0.012	0.002	0.358	5E-14	7.17E-05	31.407
	rs814197	LINC01748	G	T	-0.011	0.002	0.467	2E-11	5.68E-05	24.882
	rs830622	RP11	C	T	0.012	0.002	0.171	3.8E-09	4.40E-05	19.251
	rs898751	MNT	T	C	0.010	0.002	0.493	3E-10	5.02E-05	21.985
	rs909892	FTLP1	A	G	-0.014	0.002	0.135	9E-10	4.79E-05	20.979
	rs9300594	PCCA	G	A	0.011	0.002	0.254	9.1E-10	4.75E-05	20.803
	rs9471333	LRFN2	T	C	-0.010	0.002	0.552	6.7E-11	5.38E-05	23.546
	rs9834970	LINC02033	C	T	-0.009	0.002	0.498	2E-08	3.97E-05	17.375
	rs9867121	ZBTB20	A	C	-0.012	0.002	0.184	1.4E-08	4.11E-05	18.007
	rs9867437	CADM2	C	A	-0.010	0.002	0.460	1.3E-10	5.28E-05	23.103
	rs996234	PDE4D	A	G	-0.011	0.002	0.516	1.6E-10	5.55E-05	24.308
PC	rs10208088	AC114765.1	T	C	-0.010	0.002	0.580	3E-08	5.11E-05	18.448
	rs1037091	KCNJ3	T	C	-0.015	0.002	0.327	5.9E-15	1.05E-04	38.075
	rs10518019	AC112518.3	G	A	0.010	0.002	0.476	4.9E-08	4.93E-05	17.802
	rs10828248	MLLT10	G	A	0.011	0.002	0.345	2.8E-08	5.13E-05	18.505
	rs11259902	RP11	A	C	0.013	0.002	0.200	1.6E-08	5.34E-05	19.273
	rs112600282	LINC01876	G	A	-0.017	0.003	0.110	7.2E-09	5.62E-05	20.285
	rs113851275	PTCH1	A	G	0.019	0.003	0.108	2.5E-10	6.66E-05	24.030
	rs11576509	SORT1	T	C	0.033	0.005	0.030	2.1E-09	6.14E-05	22.152
	rs11634155	AC009878.2	C	T	-0.012	0.002	0.335	2.5E-09	6.01E-05	21.702
	rs11652437	RP11	A	C	0.013	0.002	0.324	1E-10	7.15E-05	25.823
	rs11749912	MEF2C	G	A	-0.013	0.002	0.575	3.7E-12	8.11E-05	29.285
	rs11942953	LINC02174	C	T	-0.010	0.002	0.537	1.3E-08	5.44E-05	19.623
	rs12128707	NEGR1	G	A	0.012	0.002	0.264	7.1E-09	5.63E-05	20.313
	rs12145677	SYPL2	A	G	0.016	0.002	0.297	6.4E-15	1.01E-04	36.594
	rs1229984	ADH1B	C	T	-0.034	0.006	0.973	4.4E-10	6.32E-05	22.799
	rs12521638	HMP19	G	A	0.010	0.002	0.447	4.2E-08	5.02E-05	18.119
	rs12706626	POT1	A	G	0.010	0.002	0.384	2.9E-08	5.12E-05	18.495
	rs12820967	RP11	C	T	0.012	0.002	0.322	1.5E-09	6.18E-05	22.298
	rs13262595	TSNARE1	G	A	0.016	0.002	0.561	1.8E-17	1.20E-04	43.449
	rs13422733	RFX8	T	C	-0.015	0.003	0.126	4.1E-08	5.04E-05	18.190
	rs136553	LINC01422	T	C	0.011	0.002	0.377	2E-09	6.01E-05	21.678
	rs1395020	RP11	A	G	-0.011	0.002	0.303	3.4E-08	5.11E-05	18.431
	rs1448355	NTM	T	C	0.012	0.002	0.618	8E-11	7.09E-05	25.606
	rs1469249	RP11	A	G	-0.013	0.002	0.211	8E-09	5.60E-05	20.198
	rs147543875	DNMBP	T	C	-0.036	0.006	0.023	1.5E-08	5.85E-05	21.099
	rs1524909	RNU6-546P	G	A	0.011	0.002	0.342	3.7E-08	5.05E-05	18.215
	rs1648906	RPL12P40	A	G	-0.011	0.002	0.321	2.1E-08	5.32E-05	19.183
	rs166835	SEMA6D	T	C	-0.011	0.002	0.556	4.3E-09	5.78E-05	20.871

rs16912540	ARNTL	G	A	-0.016	0.003	0.137	2.7E-09	5.91E-05	21.322
rs17167210	EXOC4	A	G	-0.011	0.002	0.436	6E-10	6.39E-05	23.052
rs17789218	RP3	C	T	0.013	0.002	0.245	2.1E-09	5.97E-05	21.529
rs17862355	ZNF800	G	T	-0.011	0.002	0.442	1E-09	6.20E-05	22.375
rs1987942	RP11	C	T	-0.011	0.002	0.617	5.4E-09	5.78E-05	20.861
rs2032780	SPAG16	C	T	0.012	0.002	0.406	4.5E-11	7.36E-05	26.550
rs2041687	RP11	G	T	0.012	0.002	0.549	3.8E-10	6.79E-05	24.503
rs2068625	C4orf45	C	T	0.014	0.002	0.698	1E-12	8.46E-05	30.547
rs206965	COX6A1	C	T	-0.013	0.002	0.791	7.9E-09	5.54E-05	19.984
rs2120461	RERE	T	C	0.012	0.002	0.661	2.5E-10	6.65E-05	24.010
rs2307022	PRMT7	G	A	-0.011	0.002	0.668	8.3E-09	5.52E-05	19.910
rs246723	PCDHB5	G	A	-0.011	0.002	0.590	1.2E-08	5.50E-05	19.866
rs2588543	RP11	T	C	0.011	0.002	0.672	2.2E-08	5.25E-05	18.931
rs2734833	DRD2	A	G	0.012	0.002	0.607	3.8E-11	7.31E-05	26.379
rs2748985	TMEM52	C	T	0.012	0.002	0.544	9.4E-12	7.75E-05	27.961
rs2761438	KCNC4	G	A	-0.011	0.002	0.624	1.7E-09	6.03E-05	21.764
rs28710456	GATB	C	T	-0.010	0.002	0.490	1.2E-08	5.41E-05	19.532
rs306755	UBOX5	C	T	0.010	0.002	0.475	1.4E-08	5.37E-05	19.367
rs34179846	DYNLL1	C	T	-0.017	0.003	0.105	1E-08	5.45E-05	19.687
rs34238696	LINC01202	G	A	-0.017	0.003	0.107	1.3E-08	5.39E-05	19.468
rs3730399	E2F4	G	A	-0.023	0.004	0.064	9.1E-10	6.26E-05	22.590
rs4704043	TNPO1	T	C	0.012	0.002	0.714	8.9E-09	5.51E-05	19.878
rs4852252	ZNF638	C	T	0.010	0.002	0.564	3E-08	5.11E-05	18.443
rs56229818	ALDH1A2	C	T	-0.010	0.002	0.484	3E-08	5.12E-05	18.461
rs585282	AUTS2	T	C	0.011	0.002	0.648	2.8E-09	5.90E-05	21.292
rs58638214	NA	T	C	-0.013	0.002	0.398	6.7E-12	7.89E-05	28.465
rs6028090	CDH4	A	G	0.013	0.002	0.555	1.3E-11	7.76E-05	28.009
rs613872	TCF4	T	G	-0.016	0.002	0.827	7.7E-11	7.07E-05	25.528
rs62553704	RP11	T	C	0.023	0.004	0.058	7.7E-09	5.67E-05	20.472
rs627685	TCF4	C	T	-0.013	0.002	0.304	3.2E-10	6.69E-05	24.138
rs6449708	AC116606.1	C	T	-0.011	0.002	0.532	7.9E-09	5.57E-05	20.108
rs6780848	LMCD1-AS1	G	T	0.011	0.002	0.270	3.3E-08	5.09E-05	18.383
rs6935828	AL356739.1	T	C	0.010	0.002	0.556	3.1E-08	5.10E-05	18.417
rs7020477	AMBP	G	A	-0.012	0.002	0.267	7E-09	5.61E-05	20.250
rs707926	VAR5	A	G	0.015	0.003	0.150	1.2E-08	5.40E-05	19.498
rs7209653	AKAP10	C	T	-0.013	0.002	0.295	2.2E-11	7.46E-05	26.930
rs7221299	B9D1	A	G	-0.019	0.003	0.107	3.5E-10	6.55E-05	23.643
rs72828532	RP1	C	T	0.016	0.002	0.179	4.5E-11	7.24E-05	26.126
rs72847500	MDGA1	C	T	0.016	0.003	0.121	1.9E-08	5.31E-05	19.181
rs7288455	CACNA1I	G	A	-0.011	0.002	0.567	1.1E-08	5.46E-05	19.719
rs7335281	MIR4704	G	A	-0.013	0.002	0.779	2.7E-09	5.91E-05	21.326
rs73578186	DENND1A	T	C	-0.012	0.002	0.324	3.7E-10	6.62E-05	23.884
rs7460106	ADGRB1	C	T	0.014	0.002	0.236	3.3E-10	6.77E-05	24.432
rs7485383	C12orf40	A	G	-0.013	0.002	0.754	1.6E-09	6.04E-05	21.784
rs7526112	CCDC18	G	T	-0.011	0.002	0.362	1.1E-08	5.43E-05	19.612
rs75550998	AC079248.1	T	G	-0.022	0.004	0.054	4.6E-08	5.08E-05	18.351

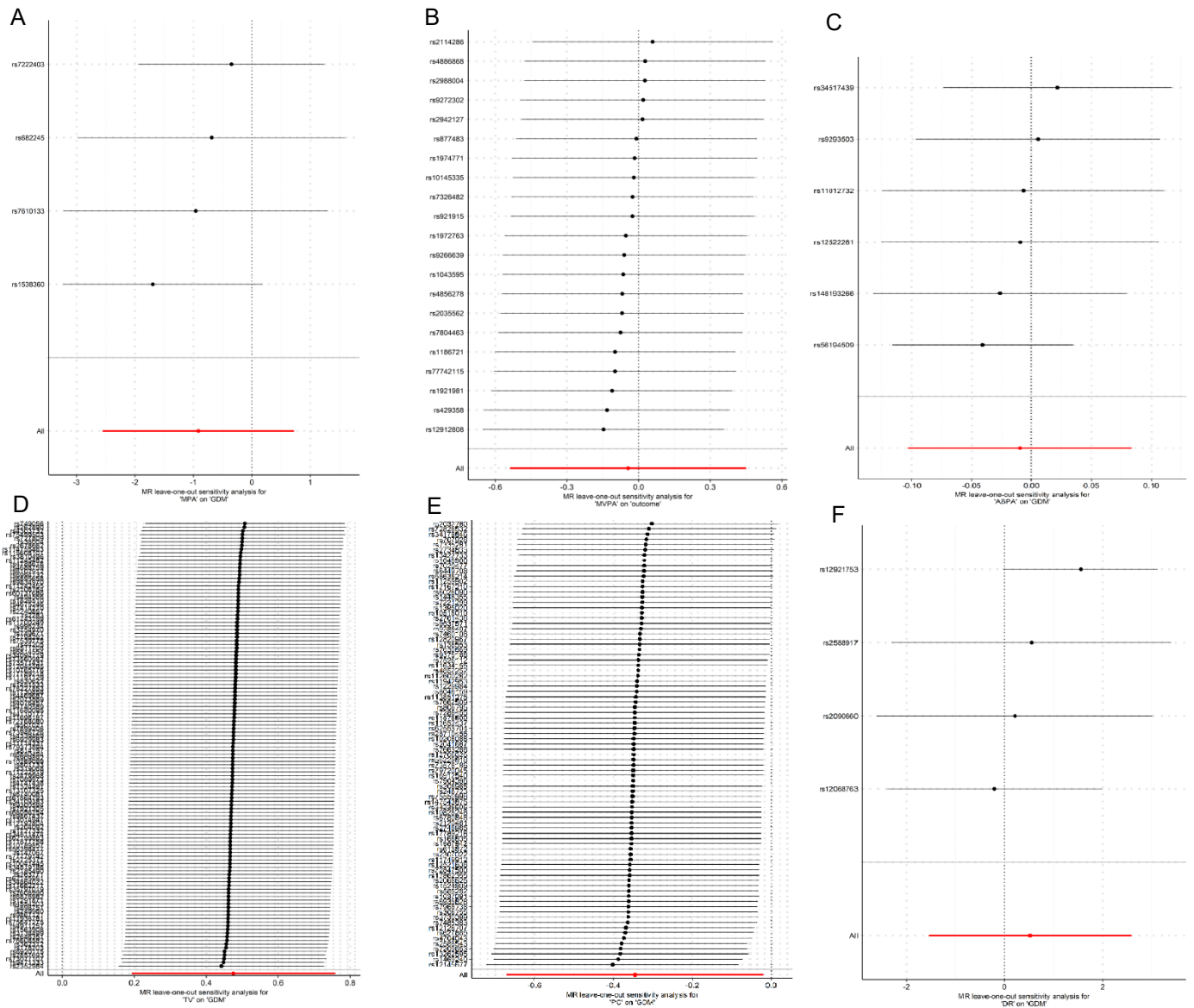
	rs7630869	DAG1	T	C	0.016	0.002	0.304	4E-16	1.10E-04	39.673
	rs7662509	RNU6-887P	A	G	0.011	0.002	0.428	6.6E-09	5.62E-05	20.289
	rs7663288	RP11	G	A	0.012	0.002	0.729	1.2E-08	5.45E-05	19.665
	rs7904398	CTNNA3	T	C	-0.010	0.002	0.503	2.4E-08	5.20E-05	18.774
	rs7968738	RP11	A	G	-0.012	0.002	0.264	2.4E-09	5.99E-05	21.615
	rs79720045	RP11	C	T	-0.013	0.002	0.401	1.8E-11	7.82E-05	28.235
	rs8046159	PKD1L3	G	A	0.010	0.002	0.518	1.7E-08	5.31E-05	19.151
	rs806795	HIST1H4E	A	G	0.010	0.002	0.470	1.4E-08	5.34E-05	19.284
	rs9288497	VWC2L	G	A	0.014	0.002	0.238	8.1E-11	7.03E-05	25.372
	rs9375188	RP11	T	C	0.016	0.002	0.484	5E-18	1.26E-04	45.301
	rs9537571	PRR20A	A	G	0.019	0.003	0.096	1.1E-09	6.21E-05	22.414
DR	rs11057408	ZNF664	T	G	-0.011	0.002	0.334	1.2E-08	5.69E-05	17.686
	rs12068763	RP11	G	T	0.012	0.002	0.219	3.7E-08	5.33E-05	16.562
	rs12921753	DOC2A	T	C	0.012	0.002	0.400	2.9E-10	6.96E-05	21.631
	rs2090660	AC068492.1	T	C	-0.013	0.002	0.194	3.7E-08	5.35E-05	16.622
	rs2588917	C10orf107	A	C	-0.010	0.002	0.448	3.4E-08	5.39E-05	16.734
	rs975303	RP1	G	A	0.015	0.002	0.181	1.3E-09	6.48E-05	20.117

Figure S1. Scatter plot of SNPs effect sizes with MR-PRESSO outlier removed



A MPA and GDM, B MVPA and GDM, C ABPA and GDM, D TV and GDM, F PC and GDM, D DR and GDM

Figure S2. Leave-one-out analysis with MR-PRESSO outlier removed



A MPA and GDM, B MVPA and GDM, C ABPA and GDM, D TV and GDM, F PC and GDM, D DR and GDM