

**Table S-7. Power analyses, discovery datasets.**

Condition	Type I error ( $\alpha$ )	Quanto		Simulated					
				Fast epistasis			BOOST		
		Int OR = 1.25	Int OR = 1.50	f = 0.15	f = 0.20	f = 0.25	f = 0.15	f = 0.20	f = 0.25
<b>Allergic rhinitis</b> Cases = 10,258 Controls = 30,933 Prev = 0.25 b = 0.243, 0.241, 0.238	E-7	0.439	0.999	1.00	1.00	1.00	1.00	1.00	1.00
	E-8	0.289	0.999	1.00	1.00	1.00	1.00	1.00	1.00
	E-9	0.175	0.999	0.93	1.00	1.00	1.00	1.00	1.00
	E-10	0.099	0.999	0.91	1.00	1.00	1.00	1.00	1.00
	E-11	0.051	0.997	0.87	1.00	1.00	1.00	1.00	1.00
	E-12	0.025	0.992	0.73	1.00	1.00	1.00	1.00	1.00
<b>Asthma</b> Cases = 6,486 Controls = 34,669 Prev = 0.15 b = 0.146, 0.144, 0.143	E-7	0.187	0.999	0.63	0.99	1.00	0.41	0.93	1.00
	E-8	0.098	0.996	0.48	0.95	1.00	0.25	0.91	1.00
	E-9	0.047	0.987	0.27	0.92	1.00	0.16	0.79	0.99
	E-10	0.021	0.970	0.19	0.86	1.00	0.08	0.68	0.99
	E-11	0.009	0.938	0.12	0.73	0.99	0.03	0.57	0.99
	E-12	0.004	0.888	0.08	0.64	0.99	0.01	0.51	0.99
<b>Cardiac disease</b> Cases = 11,069 Controls = 28,979 Prev = 0.25 b = 0.243, 0.241, 0.239	E-7	0.475	0.999	1.00	1.00	1.00	1.00	1.00	1.00
	E-8	0.321	0.999	1.00	1.00	1.00	0.99	1.00	1.00
	E-9	0.199	0.999	0.99	1.00	1.00	0.99	1.00	1.00
	E-10	0.115	0.999	0.99	1.00	1.00	0.95	1.00	1.00
	E-11	0.062	0.998	0.97	1.00	1.00	0.90	1.00	1.00
	E-12	0.031	0.995	0.92	1.00	1.00	0.84	1.00	1.00
<b>Depression</b> Cases = 4,824 Controls = 36,162 Prev = 0.15 b = 0.146, 0.145, 0.143	E-7	0.081	0.981	0.29	0.81	1.00	0.18	0.57	0.95
	E-8	0.036	0.953	0.21	0.69	0.99	0.07	0.49	0.92
	E-9	0.015	0.903	0.14	0.54	0.93	0.01	0.38	0.87
	E-10	0.006	0.827	0.04	0.41	0.89	0.01	0.29	0.82
	E-11	0.002	0.727	0.01	0.33	0.84	0.01	0.21	0.73
	E-12	0.001	0.610	0.01	0.27	0.80	0.00	0.11	0.63
<b>Dermatophytosis</b> Cases = 5,163 Controls = 36,083 Prev = 0.15 b = 0.146, 0.145, 0.143	E-7	0.100	0.989	0.45	0.96	1.00	0.24	0.85	1.00
	E-8	0.046	0.971	0.28	0.89	1.00	0.11	0.75	1.00
	E-9	0.020	0.935	0.15	0.81	1.00	0.04	0.57	0.99
	E-10	0.008	0.876	0.08	0.71	1.00	0.02	0.45	0.94
	E-11	0.003	0.793	0.04	0.56	0.98	0.00	0.27	0.90
	E-12	0.001	0.689	0.01	0.42	0.95	0.00	0.20	0.85
<b>Diabetes, type 2</b> Cases = 4,563 Controls = 35,573 Prev = 0.15 b = 0.146, 0.145, 0.143	E-7	0.067	0.973	0.21	0.74	0.99	0.10	0.55	0.95
	E-8	0.029	0.933	0.14	0.59	0.97	0.05	0.44	0.87
	E-9	0.011	0.868	0.08	0.50	0.92	0.02	0.28	0.81
	E-10	0.004	0.777	0.02	0.34	0.84	0.01	0.18	0.72
	E-11	0.001	0.663	0.01	0.25	0.79	0.01	0.12	0.60
	E-12	0.001	0.539	0.01	0.19	0.74	0.00	0.06	0.51
<b>Dyslipidaemia</b> Cases = 23,061 Controls = 17,021 Prev = 0.55 b = 0.535	E-7	0.582	0.999	1.00	N/A	N/A	1.00	N/A	N/A
	E-8	0.422	0.999	1.00	N/A	N/A	1.00	N/A	N/A
	E-9	0.282	0.999	1.00	N/A	N/A	1.00	N/A	N/A
	E-10	0.175	0.999	1.00	N/A	N/A	1.00	N/A	N/A
	E-11	0.101	0.999	1.00	N/A	N/A	1.00	N/A	N/A
	E-12	0.055	0.997	1.00	N/A	N/A	1.00	N/A	N/A
<b>Hemorrhoids</b> Cases = 6,199 Controls = 34,356 Prev = 0.15 b = 0.146, 0.145, 0.143	E-7	0.165	0.998	0.63	0.97	1.00	0.32	0.92	1.00
	E-8	0.084	0.993	0.41	0.94	1.00	0.17	0.88	1.00
	E-9	0.039	0.981	0.23	0.89	1.00	0.08	0.80	1.00
	E-10	0.017	0.957	0.15	0.85	1.00	0.06	0.66	1.00
	E-11	0.007	0.916	0.07	0.76	1.00	0.03	0.49	0.98
	E-12	0.003	0.854	0.04	0.62	0.99	0.00	0.38	0.94
<b>Hypertensive disease</b> Cases = 21,713 Controls = 18,332 Prev = 0.50 b = 0.485	E-7	0.613	0.999	1.00	N/A	N/A	1.00	N/A	N/A
	E-8	0.453	0.999	1.00	N/A	N/A	1.00	N/A	N/A
	E-9	0.310	0.999	1.00	N/A	N/A	1.00	N/A	N/A
	E-10	0.196	0.999	1.00	N/A	N/A	1.00	N/A	N/A
	E-11	0.116	0.999	1.00	N/A	N/A	1.00	N/A	N/A
	E-12	0.065	0.998	1.00	N/A	N/A	1.00	N/A	N/A
<b>Osteoarthritis</b> Cases = 15,454 Controls = 23,578 Prev = 0.40 b = 0.389, 0.385, 0.381	E-7	0.587	0.999	1.00	1.00	1.00	1.00	1.00	1.00
	E-8	0.427	0.999	1.00	1.00	1.00	1.00	1.00	1.00
	E-9	0.287	0.999	1.00	1.00	1.00	1.00	1.00	1.00
	E-10	0.179	0.999	1.00	1.00	1.00	1.00	1.00	1.00
	E-11	0.104	0.999	1.00	1.00	1.00	1.00	1.00	1.00
	E-12	0.057	0.998	1.00	1.00	1.00	1.00	1.00	1.00

f: relative penetrance. b: baseline penetrance, corresponding to each respective relative penetrance going from left to right. Green indicates power > 80%. Yellow indicates the genome-wide significance threshold. N/A: not estimated because a model penetrance would exceed 1.0.