

1 **Supplementary table 1.** Allergic disease (asthma, hay fever or eczema) genetic  
 2 instrumental variants (IVs).

SNP	EA	NEA	EAF	Beta	SE	<i>p</i> val
rs12123821	T	C	0.048	0.116	0.014	1.04E-16
rs61816766	C	T	0.980	0.142	0.018	6.76E-16
rs1214598	A	G	0.332	-0.040	0.006	2.14E-11
rs7521390	C	A	0.716	0.036	0.006	1.39E-08
rs301802	A	T	0.459	0.048	0.006	1.33E-16
rs1289273	G	A	0.573	0.035	0.006	1.09E-09
rs760805	T	A	0.578	0.037	0.006	3.79E-10
rs74847330	G	A	0.878	-0.050	0.009	1.67E-08
rs34290285	A	G	0.265	-0.077	0.008	1.16E-24
rs4973380	A	T	0.243	0.040	0.007	2.59E-09
rs10174949	A	G	0.316	-0.066	0.006	9.92E-26
rs10865050	A	G	0.153	-0.125	0.008	6.37E-50
rs6800001	A	G	0.342	0.033	0.006	2.28E-08
rs10663129	ACT	A	0.672	0.038	0.006	1.25E-09
rs61192126	C	T	0.691	-0.038	0.006	1.56E-09
rs519973	A	G	0.354	0.036	0.006	3.23E-09
rs9877752	A	G	0.412	0.040	0.006	4.98E-12
rs80064395	T	C	0.058	-0.073	0.011	1.31E-11
rs10033073	G	A	0.650	0.044	0.007	1.36E-09
rs5743618	A	C	0.299	-0.092	0.007	2.73E-42
rs228619	G	A	0.531	0.036	0.006	2.41E-10
rs58939053	T	C	0.344	0.054	0.006	3.85E-19
rs6881706	T	G	0.293	-0.071	0.006	1.73E-28
rs72774901	A	T	0.082	0.112	0.011	3.92E-25
rs740474	T	C	0.417	-0.036	0.006	6.59E-10
rs6594499	A	C	0.481	-0.072	0.006	1.10E-36
rs249677	A	C	0.361	0.037	0.006	7.54E-10
rs2910162	G	A	0.684	0.034	0.006	1.54E-08
rs16903574	G	C	0.918	0.070	0.011	1.68E-10
rs848	C	A	0.764	-0.060	0.007	1.62E-16
rs1419675	T	G	0.242	-0.039	0.007	4.72E-08
rs2854001	A	G	0.184	0.054	0.007	3.31E-14
rs2134814	G	C	0.646	-0.043	0.006	1.03E-12
rs34004019	G	A	0.696	-0.091	0.007	2.52E-38
rs9372120	G	T	0.825	0.041	0.007	1.02E-08
rs3128959	A	G	0.124	-0.060	0.010	2.25E-10
rs4296977	T	C	0.158	-0.053	0.008	6.92E-11
rs6461503	C	T	0.527	-0.041	0.006	8.81E-13
rs17664743	A	G	0.204	0.041	0.007	8.27E-09

rs2221641	T	C	0.388	-0.042	0.006	1.03E-12
rs6990534	G	A	0.643	-0.040	0.006	1.74E-10
rs12551834	A	G	0.080	-0.062	0.010	2.72E-09
rs144829310	T	G	0.157	0.083	0.008	2.60E-26
rs2477923	C	T	0.502	-0.033	0.006	7.23E-09
rs62626322	G	T	0.903	0.067	0.009	1.35E-13
rs12413578	T	C	0.099	-0.093	0.009	3.31E-23
rs479844	G	A	0.571	0.041	0.006	1.15E-12
rs2212434	T	C	0.429	0.087	0.006	8.92E-52
rs10789841	C	T	0.691	-0.046	0.006	1.48E-12
rs12365699	A	G	0.153	-0.059	0.008	3.54E-14
rs11236814	T	A	0.908	-0.065	0.010	3.25E-11
rs11033545	G	T	0.558	0.033	0.006	2.40E-08
rs11168245	G	C	0.801	-0.047	0.007	1.41E-11
rs6489785	C	T	0.631	-0.043	0.006	3.57E-13
rs1689510	C	G	0.316	0.051	0.006	3.39E-17
rs1059513	C	T	0.890	-0.083	0.009	1.15E-18
rs4943794	C	G	0.226	0.040	0.007	1.41E-08
rs1885013	A	G	0.359	-0.038	0.006	1.33E-09
rs10519067	A	G	0.140	-0.052	0.009	1.10E-09
rs8030821	T	A	0.611	0.034	0.006	1.54E-08
rs3540	A	G	0.345	-0.035	0.006	1.28E-08
rs12440045	C	A	0.548	0.040	0.006	7.68E-12
rs56375023	A	G	0.213	0.073	0.007	3.11E-27
rs3024665	T	C	0.077	0.067	0.012	2.18E-08
rs2241099	G	C	0.738	-0.070	0.007	4.62E-26
rs12941864	T	C	0.466	-0.034	0.006	4.98E-08
rs7224129	A	G	0.473	0.054	0.006	8.11E-21
rs7406234	C	T	0.565	-0.034	0.006	4.30E-09
rs11658582	G	C	0.566	0.056	0.006	2.07E-21
rs10414065	T	C	0.078	-0.092	0.012	2.29E-14
rs6011033	G	A	0.776	0.044	0.007	2.66E-10
rs2766678	A	G	0.213	-0.056	0.007	2.95E-14
rs12625547	G	T	0.786	-0.043	0.008	1.98E-08
rs5758343	T	A	0.782	-0.047	0.007	2.17E-11

3 SNP: single-nucleotide polymorphism. EA: effect allele. NEA: non-effect allele. EAF:  
4 effect allele frequency. Beta: the regression coefficient based on Allergic disease  
5 (asthma, hay fever or eczema) raising effect allele. SE: standard error.

6

7 **Supplementary table 2.** Genome-wide association study (GWAS) for COVID-19.

<b>GWAS ID</b>	<b>Year</b>	<b>Trait</b>	<b>ncase</b>	<b>ncontrol</b>	<b>nsnp</b>	<b>Population</b>	<b>PMID</b>
ebi-a-GCST010780	2020	COVID-19 (RELEASE 4)	14,134	1,284,876	12,508,741	European	32404885

8 COVID-19: corona virus disease 2019; GWAS ID: genome wide association study

9 identity; ncase: the number of MS case; ncontrol: the number of the control; nsnp: the

10 number of single-nucleotide polymorphism; PMID: pubMed unique identifier.

11

12 **Supplementary table 3.** Association of allergic disease genetic IVs in COVID-19

13 GWAS dataset.

SNP	Exposure (allergic disease) GWAS			Outcome (COVID-19) GWAS		
	Beta	SE	<i>p</i> val	Beta	SE	<i>p</i> val
rs10033073	0.044	0.007	1.36E-09	-0.001	0.014	0.963
rs10174949	-0.066	0.006	9.92E-26	-0.003	0.014	0.849
rs10414065	-0.092	0.012	2.29E-14	0.020	0.029	0.485
rs10519067	-0.052	0.009	1.10E-09	0.000	0.017	0.997
rs1059513	-0.083	0.009	1.15E-18	-0.006	0.021	0.779
rs10663129	0.038	0.006	1.25E-09	0.002	0.018	0.928
rs10789841	-0.046	0.006	1.48E-12	0.004	0.015	0.796
rs10865050	-0.125	0.008	6.37E-50	0.016	0.017	0.358
rs11033545	0.033	0.006	2.40E-08	-0.005	0.015	0.737
rs11168245	-0.047	0.007	1.41E-11	-0.016	0.016	0.294
rs11236814	-0.065	0.010	3.25E-11	-0.008	0.022	0.716
rs11658582	0.056	0.006	2.07E-21	0.005	0.014	0.734
rs12123821	0.116	0.014	1.04E-16	-0.007	0.037	0.859
rs1214598	-0.040	0.006	2.14E-11	0.004	0.015	0.803
rs12365699	-0.059	0.008	3.54E-14	0.030	0.019	0.104
rs12413578	-0.093	0.009	3.31E-23	0.025	0.021	0.246
rs12440045	0.040	0.006	7.68E-12	0.009	0.015	0.538
rs12551834	-0.062	0.010	2.72E-09	0.010	0.022	0.654
rs12625547	-0.043	0.008	1.98E-08	-0.014	0.017	0.414
rs1289273	0.035	0.006	1.09E-09	0.013	0.015	0.364
rs12941864	-0.034	0.006	4.98E-08	0.018	0.015	0.228
rs1419675	-0.039	0.007	4.72E-08	-0.024	0.015	0.111
rs144829310	0.083	0.008	2.60E-26	0.028	0.018	0.115
rs1689510	0.051	0.006	3.39E-17	-0.019	0.015	0.195
rs16903574	0.070	0.011	1.68E-10	-0.010	0.028	0.730
rs17664743	0.041	0.007	8.27E-09	-0.011	0.015	0.489
rs1885013	-0.038	0.006	1.33E-09	0.013	0.014	0.348
rs2134814	-0.043	0.006	1.03E-12	0.015	0.014	0.283
rs2212434	0.087	0.006	8.92E-52	-0.032	0.013	0.017
rs2221641	-0.042	0.006	1.03E-12	0.006	0.013	0.644
rs2241099	-0.070	0.007	4.62E-26	0.010	0.015	0.496
rs228619	0.036	0.006	2.41E-10	-0.007	0.013	0.596
rs2477923	-0.033	0.006	7.23E-09	-0.020	0.013	0.141
rs249677	0.037	0.006	7.54E-10	0.008	0.013	0.535
rs2766678	-0.056	0.007	2.95E-14	0.015	0.025	0.553
rs2854001	0.054	0.007	3.31E-14	-0.032	0.020	0.115
rs2910162	0.034	0.006	1.54E-08	-0.010	0.014	0.481
rs301802	0.048	0.006	1.33E-16	0.014	0.013	0.292

rs3024665	0.067	0.012	2.18E-08	0.011	0.024	0.638
rs3128959	-0.060	0.010	2.25E-10	-0.015	0.022	0.491
rs34004019	-0.091	0.007	2.52E-38	0.022	0.019	0.233
rs34290285	-0.077	0.008	1.16E-24	-0.003	0.014	0.816
rs3540	-0.035	0.006	1.28E-08	-0.006	0.014	0.683
rs4296977	-0.053	0.008	6.92E-11	-0.019	0.020	0.342
rs479844	0.041	0.006	1.15E-12	0.002	0.013	0.871
rs4943794	0.040	0.007	1.41E-08	0.001	0.017	0.950
rs4973380	0.040	0.007	2.59E-09	0.022	0.016	0.163
rs519973	0.036	0.006	3.23E-09	-0.009	0.016	0.559
rs56375023	0.073	0.007	3.11E-27	0.000	0.016	0.982
rs5743618	-0.092	0.007	2.73E-42	0.001	0.016	0.931
rs5758343	-0.047	0.007	2.17E-11	0.020	0.018	0.257
rs58939053	0.054	0.006	3.85E-19	-0.015	0.016	0.376
rs6011033	0.044	0.007	2.66E-10	0.021	0.016	0.204
rs61192126	-0.038	0.006	1.56E-09	-0.009	0.015	0.537
rs61816766	0.142	0.018	6.76E-16	-0.077	0.047	0.105
rs62626322	0.067	0.009	1.35E-13	-0.011	0.021	0.589
rs6461503	-0.041	0.006	8.81E-13	0.008	0.013	0.573
rs6489785	-0.043	0.006	3.57E-13	0.016	0.014	0.246
rs6594499	-0.072	0.006	1.10E-36	-0.013	0.014	0.350
rs6800001	0.033	0.006	2.28E-08	0.019	0.014	0.164
rs6881706	-0.071	0.006	1.73E-28	-0.005	0.014	0.738
rs6990534	-0.040	0.006	1.74E-10	0.011	0.013	0.420
rs7224129	0.054	0.006	8.11E-21	-0.016	0.013	0.216
rs72774901	0.112	0.011	3.92E-25	-0.082	0.025	0.001
rs740474	-0.036	0.006	6.59E-10	0.026	0.013	0.051
rs7406234	-0.034	0.006	4.30E-09	-0.013	0.013	0.354
rs74847330	-0.050	0.009	1.67E-08	0.022	0.020	0.283
rs7521390	0.036	0.006	1.39E-08	-0.032	0.015	0.026
rs760805	0.037	0.006	3.79E-10	-0.012	0.013	0.355
rs80064395	-0.073	0.011	1.31E-11	0.000	0.024	0.996
rs8030821	0.034	0.006	1.54E-08	-0.016	0.015	0.298
rs848	-0.060	0.007	1.62E-16	0.022	0.015	0.151
rs9372120	0.041	0.007	1.02E-08	-0.004	0.017	0.802
rs9877752	0.040	0.006	4.98E-12	0.004	0.014	0.774

14 COVID-19: corona virus disease 2019; GWAS: genome wide association study; SNP:  
15 single-nucleotide polymorphism; Beta: the regression coefficient based on the allergic  
16 disease effect allele; SE: standard error.

17

18 **Supplementary table 4.** Pleiotropy and heterogeneity test of allergic disease genetic

19 IVs in COVID-19 GWAS.

Pleiotropy test				Heterogeneity test					
MR_Egger			PRESSO	MR Egger			IVW		
Intercept	SE	<i>p</i> val	<i>p</i> val	Q	Q_df	<i>p</i> val	Q	Q_df	<i>p</i> val
0.007	0.005	0.181	0.494	69.990	72	0.545	71.812	73	0.517

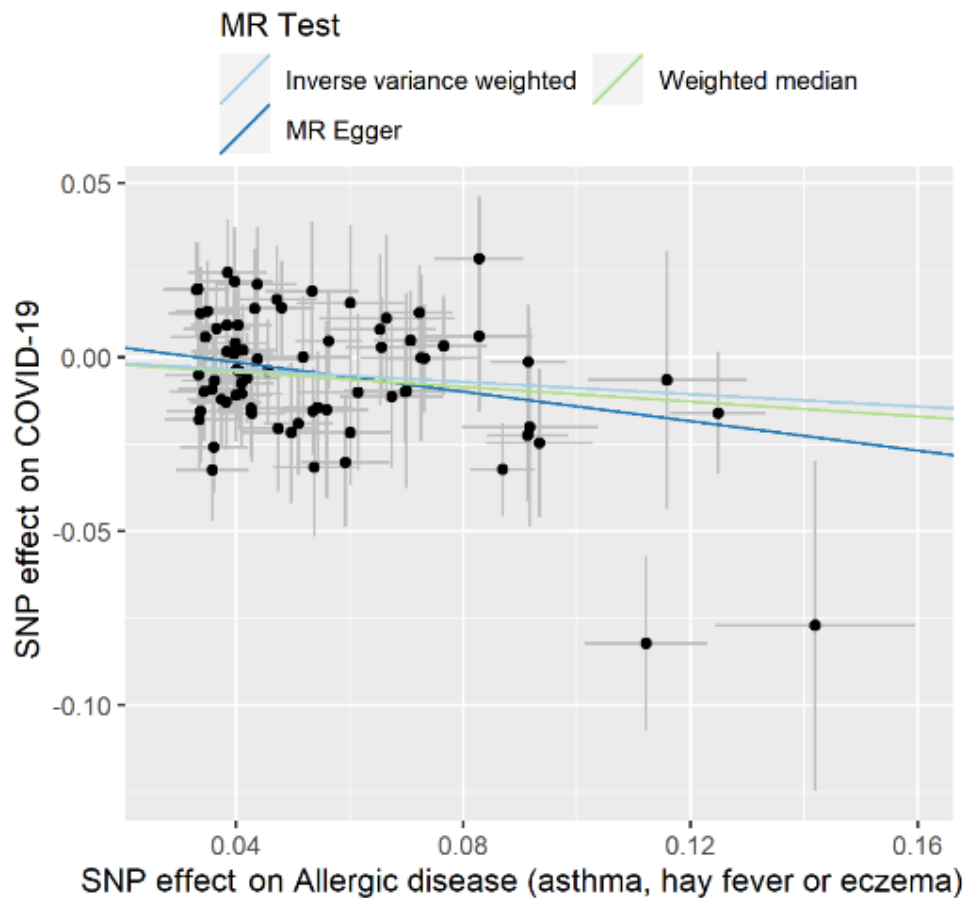
20 COVID-19: corona virus disease 2019; GWAS: genome wide association study; IVW:

21 inverse variance weighted; SE: standard error. *p* val > 0.05 represent no significant

22 pleiotropy or heterogeneity.

23

24 **Supplementary figure 1.**



25

26 **Supplementary figure 1. Individual estimates about the causal effect of allergic**

27 **disease on COVID-19.** The x-axis shows the SNP (single nucleotide polymorphism)

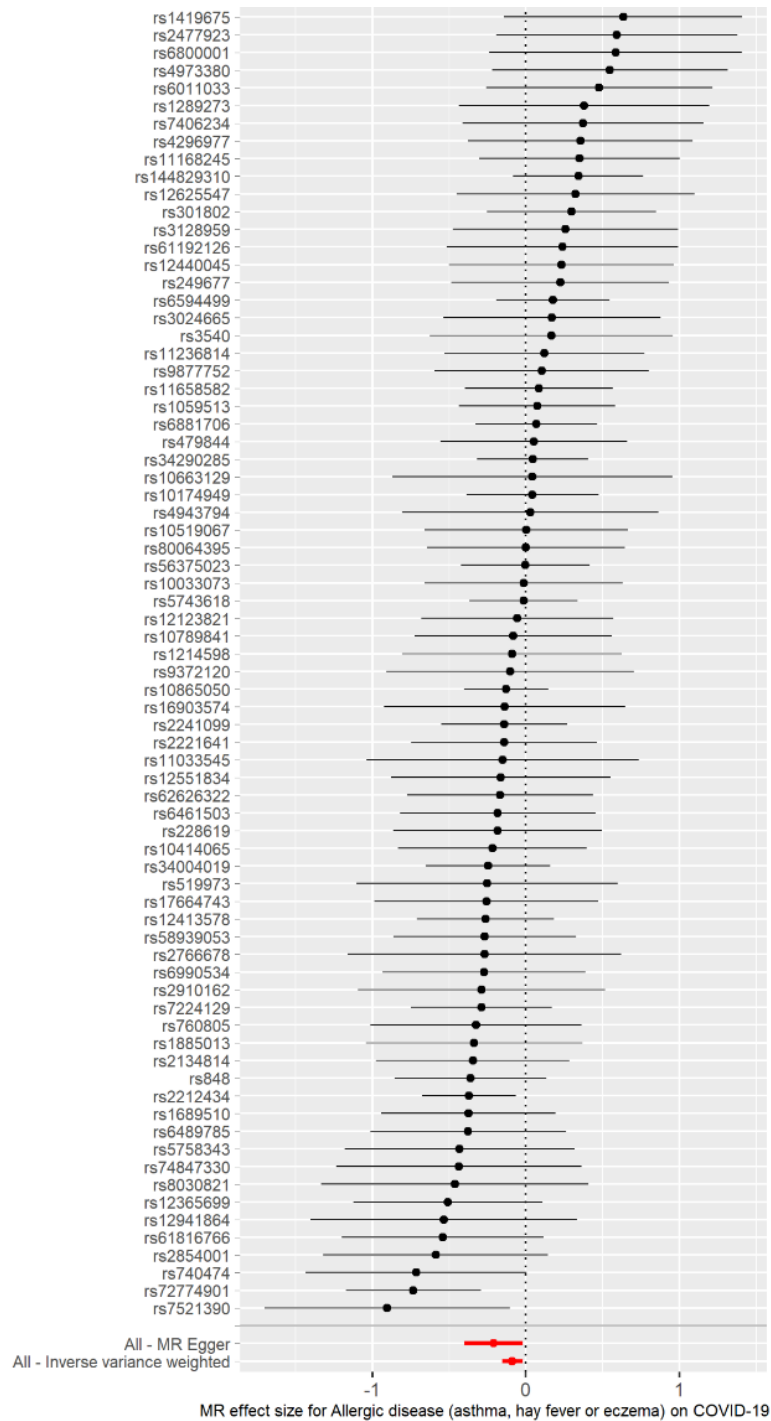
28 effect and SE (standard error) on each of allergic disease. The y-axis shows the SNP

29 effect and SE on COVID-19 by analyzing GWAS ID: ebi-a-GCST010780. The

30 regression line for MR Egger, Weighted median, and IVW is shown.

31

32 **Supplementary figure 2.**

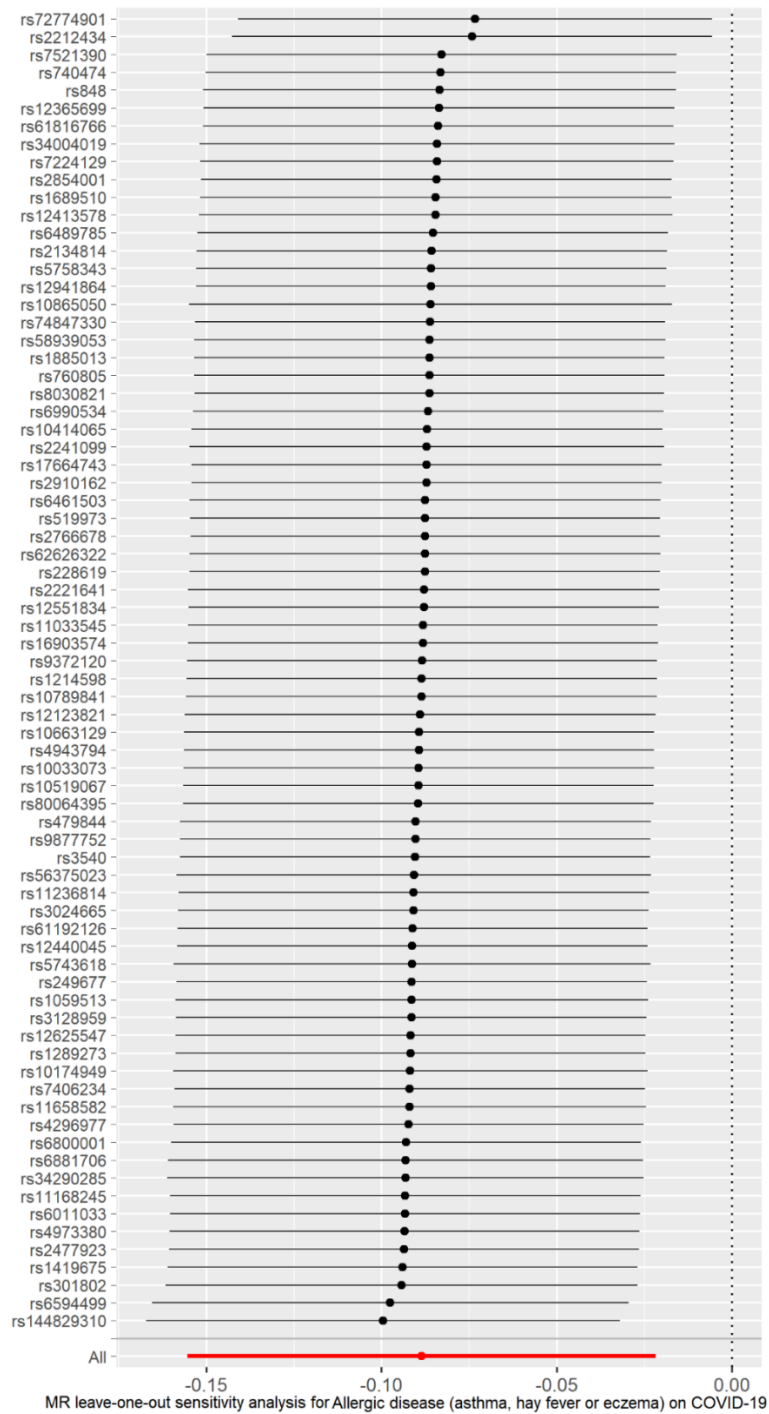


33

34 **Supplementary figure 2. Forest plot of allergic disease associated with risk of**  
35 **COVID-19.** The x-axis shows MR effect size for allergic disease on COVID-19 by  
36 analyzing GWAS ID: ebi-a-GCST010780. The y-axis shows the analysis for each of  
37 SNPs.



38 **Supplementary figure 3.**



39

40 **Supplementary figure 3. MR leave-one-out sensitivity analysis for the effect of**  
41 **allergic disease SNPs on COVID-19.** The x-axis shows MR leave-one-out sensitivity  
42 analysis for allergic disease on COVID-19 by analyzing GWAS ID: ebi-a-GCST010780.  
43 The y-axis shows the analysis for the effect of leave-one-out of SNPs on COVID-19.