

Supplementary Table S1: Baseline characteristics of hand grip strength and pulmonary function.

Exposures/Outcomes	Trait	GWAS ID	Year	Consortiu m	Populatio n	Sample size	Author	<i>n</i> SNPs
HGS	RHGS	ukb-b-10215	2018	MRC-IEU	European	461,089	Ben Elsworth	9,851,867
	LHGS	ukb-b-7478	2018	MRC-IEU	European	461,026	Ben Elsworth	9,851,867
PF	FVC	ukb-b-7953	2018	MRC-IEU	European	421,986	Ben Elsworth	9,851,867
	FEV1	ukb-b-19657	2018	MRC-IEU	European	421,986	Ben Elsworth	9,851,867
	FEV1/ FVC	ebi-a- GCST007431	2019	NA	European	321,047	Shrine N	19,671,887

HGS, handgrip strength, RHGS, right handgrip strength; LHGS, left handgrip strength; PF, pulmonary function; FVC, forced vital capacity; FEV1, forced expiratory volume in the first second. NA, not available.

Supplementary Table S2: Single nucleotide polymorphisms used as instrumental variables in the Mendelian randomization analysis of right-hand grip strength.

SNP	Chr	EA	NEA	Beta	SE	<i>p</i> -Value	R ²	F-Value
rs10798876	1	G	C	0.009	0.001	4.30E-09	7.48E-05	34
rs4927015	1	A	G	0.013	0.002	5.00E-18	1.62E-04	75
rs35304341	1	A	G	-0.014	0.003	4.00E-08	6.53E-05	30
rs56144131	1	C	T	-0.013	0.002	3.80E-10	8.51E-05	39
rs7549184	1	A	G	0.011	0.002	5.80E-09	7.35E-05	34
rs12562146	1	A	T	0.012	0.002	2.00E-08	6.83E-05	31
rs2147461	1	C	T	0.013	0.002	6.10E-09	7.33E-05	34
rs6693567	1	T	C	-0.010	0.002	6.30E-09	7.32E-05	34
rs150330307	1	C	T	-0.033	0.004	1.20E-14	1.29E-04	60
rs1442883	2	A	C	-0.011	0.002	5.80E-10	8.32E-05	38
rs35833641	2	G	A	0.009	0.002	8.50E-09	7.19E-05	33
rs2894602	2	G	A	0.010	0.002	9.90E-09	7.13E-05	33
rs7565148	2	G	T	-0.010	0.001	3.60E-12	1.05E-04	48
rs7576964	2	T	G	0.010	0.002	5.30E-10	8.37E-05	39
rs34030812	2	C	T	-0.009	0.002	3.30E-09	7.59E-05	35
rs7575451	2	G	C	-0.011	0.002	9.30E-12	1.01E-04	46
rs12616285	2	G	T	0.012	0.002	5.40E-09	7.39E-05	34
rs6715064	2	T	C	-0.009	0.002	9.60E-09	7.14E-05	33
rs1641457	2	G	T	0.013	0.002	2.40E-13	1.16E-04	54
rs3771498	2	T	C	0.014	0.001	1.90E-21	1.96E-04	90
rs12052508	2	T	C	-0.013	0.002	4.70E-09	7.44E-05	34
rs10193039	2	T	A	-0.010	0.002	4.10E-10	8.47E-05	39
rs2194747	2	G	A	0.010	0.002	1.90E-09	7.83E-05	36
rs6792762	3	A	G	-0.009	0.002	1.80E-09	7.85E-05	36
rs1440152	3	G	C	0.008	0.001	3.50E-08	6.59E-05	30
rs35701422	3	C	T	-0.009	0.002	1.50E-08	6.95E-05	32
rs35457492	3	C	A	0.008	0.001	2.20E-08	6.78E-05	31
rs9757079	3	T	C	0.010	0.002	8.40E-10	8.17E-05	38
rs71298370	3	A	G	0.017	0.003	8.90E-10	8.15E-05	38
rs34587452	4	C	G	-0.011	0.002	9.10E-10	8.13E-05	38
rs7657558	4	G	T	0.011	0.002	1.10E-10	9.03E-05	42
rs114924396	4	G	A	-0.019	0.003	8.20E-09	7.21E-05	33
rs997850	4	C	G	-0.009	0.002	3.70E-09	7.54E-05	35
rs13169333	5	C	T	0.009	0.002	4.30E-08	6.51E-05	30
rs75457267	5	T	C	-0.019	0.003	3.40E-08	6.60E-05	30
rs12522139	5	G	T	-0.011	0.002	6.80E-09	7.29E-05	34
rs6882168	5	T	C	-0.009	0.002	7.90E-09	7.22E-05	33
rs13356200	5	G	T	-0.009	0.002	1.80E-09	7.85E-05	36
rs6870324	5	G	C	-0.010	0.002	3.00E-09	7.63E-05	35
rs13355365	5	T	C	-0.008	0.002	3.40E-08	6.61E-05	30
rs9388051	6	A	G	0.011	0.002	2.70E-08	6.70E-05	31
rs113835839	6	T	C	-0.010	0.002	1.10E-08	7.09E-05	33

rs645144	6	C	T	-0.009	0.002	4.30E-08	6.51E-05	30
rs721101	6	C	T	0.009	0.002	1.60E-08	6.93E-05	32
rs77485342	6	T	C	0.035	0.006	2.60E-10	8.67E-05	40
rs1125	6	A	G	-0.010	0.002	1.90E-10	8.80E-05	41
rs9396861	6	A	C	-0.010	0.002	5.70E-10	8.33E-05	38
rs35175534	6	C	A	-0.019	0.002	4.20E-16	1.43E-04	66
rs852520	7	A	C	-0.009	0.002	1.50E-08	6.95E-05	32
rs6962338	7	G	A	-0.020	0.004	2.00E-08	6.84E-05	32
rs2389763	7	C	T	-0.008	0.002	3.80E-08	6.56E-05	30
rs2717351	7	G	A	0.013	0.002	3.40E-12	1.05E-04	48
rs9639938	7	G	C	0.009	0.001	5.20E-09	7.40E-05	34
rs4730984	7	T	G	0.010	0.002	1.80E-09	7.84E-05	36
rs4737446	8	T	G	0.010	0.002	2.40E-10	8.70E-05	40
rs62509875	8	G	A	-0.013	0.002	2.40E-11	9.67E-05	45
rs1486925	8	C	T	-0.010	0.002	2.90E-09	7.65E-05	35
rs116922558	9	G	A	-0.025	0.004	1.80E-10	8.83E-05	41
rs7034200	9	A	C	0.009	0.001	5.30E-09	7.39E-05	34
rs11998884	9	T	C	0.017	0.003	2.80E-08	6.68E-05	31
rs10761411	9	T	C	-0.011	0.002	1.30E-08	7.02E-05	32
rs72820369	10	T	A	0.016	0.002	4.40E-12	1.04E-04	48
rs4751671	10	A	G	0.008	0.002	4.10E-08	6.53E-05	30
rs12412806	10	A	G	-0.009	0.002	3.00E-08	6.66E-05	31
rs2273555	10	A	G	0.011	0.002	4.20E-13	1.14E-04	53
rs4962700	10	G	C	0.009	0.002	1.20E-08	7.04E-05	32
rs1556659	10	T	C	0.018	0.002	3.80E-30	2.82E-04	130
rs11022513	11	T	C	-0.009	0.002	1.10E-09	8.07E-05	37
rs2244621	11	T	C	0.012	0.002	4.50E-08	6.49E-05	30
rs61389091	11	T	C	0.022	0.004	3.60E-09	7.55E-05	35
rs34845616	11	A	G	0.010	0.002	1.70E-08	6.90E-05	32
rs12790261	11	A	C	-0.026	0.003	2.00E-22	2.06E-04	95
rs72977282	11	A	T	-0.017	0.002	1.20E-28	2.67E-04	123
rs6592737	11	T	A	-0.009	0.002	2.00E-09	7.81E-05	36
rs1635527	12	C	G	0.010	0.001	6.80E-11	9.23E-05	43
rs7301953	12	A	G	-0.012	0.002	6.40E-13	1.12E-04	52
rs10846071	12	T	C	-0.016	0.002	6.50E-25	2.30E-04	106
rs12823922	12	G	A	-0.011	0.002	1.60E-10	8.86E-05	41
rs7963801	12	C	T	-0.011	0.002	8.40E-14	1.21E-04	56
rs12316046	12	G	A	-0.016	0.002	3.80E-26	2.43E-04	112
rs7953280	12	C	G	-0.009	0.001	1.80E-09	7.84E-05	36
rs2296316	14	C	T	-0.008	0.002	4.60E-08	6.48E-05	30
rs12889267	14	G	A	-0.012	0.002	6.70E-10	8.26E-05	38
rs935728	14	T	C	0.010	0.002	1.80E-09	7.86E-05	36
rs7148603	14	A	G	0.009	0.002	4.70E-09	7.44E-05	34
rs9652468	15	A	G	-0.013	0.002	3.30E-13	1.15E-04	53
rs4553566	15	C	T	-0.009	0.001	4.60E-10	8.43E-05	39
rs12914702	15	A	G	0.011	0.002	1.90E-10	8.79E-05	41
rs12899474	15	T	C	-0.015	0.002	5.40E-10	8.36E-05	39
rs11642954	16	A	G	-0.013	0.002	2.20E-12	1.07E-04	49
rs8055199	16	A	G	-0.009	0.002	1.20E-08	7.04E-05	32
rs7206195	16	T	C	-0.015	0.002	2.80E-15	1.35E-04	62
rs62037412	16	A	G	0.009	0.002	1.90E-09	7.81E-05	36
rs3848369	16	T	C	-0.010	0.002	4.70E-10	8.41E-05	39
rs76749769	16	T	C	0.014	0.003	2.20E-08	6.79E-05	31
rs4784329	16	C	A	-0.013	0.002	9.00E-19	1.70E-04	78
rs7214252	17	A	G	-0.010	0.002	2.00E-08	6.83E-05	31
rs2587505	17	C	T	-0.009	0.002	8.10E-10	8.19E-05	38
rs4793658	17	C	A	-0.014	0.002	3.80E-08	6.56E-05	30
rs56074046	17	A	G	-0.009	0.002	4.40E-09	7.47E-05	34
rs635538	18	A	G	-0.022	0.003	1.50E-16	1.48E-04	68
rs4369779	18	C	T	0.017	0.002	3.40E-21	1.94E-04	89
rs34217742	19	A	T	0.015	0.002	1.40E-10	8.94E-05	41
rs7249	19	T	C	0.008	0.002	4.00E-08	6.54E-05	30
rs4802848	19	C	G	0.011	0.002	3.80E-11	9.48E-05	44
rs79723785	19	C	T	-0.034	0.006	1.60E-08	6.92E-05	32
rs911642	20	T	C	0.009	0.002	2.00E-08	6.83E-05	31

rs6063504	20	G	C	0.009	0.001	7.80E-09	7.23E-05	33
rs2226685	21	C	T	0.010	0.002	3.10E-09	7.62E-05	35
rs6006984	22	C	T	0.010	0.002	5.10E-10	8.38E-05	39

Supplementary Table S3: Single nucleotide polymorphisms used as instrumental variables in the Mendelian randomization analysis of left-hand grip strength.

SNP	Chr	EA	NEA	Beta	SE	p-Value	R ²	F-Value
rs6680160	1	G	A	0.010	0.002	6.00E-11	9.29E-05	43
rs7516571	1	G	A	0.009	0.002	3.10E-08	6.65E-05	31
rs150330307	1	C	T	-0.031	0.004	2.90E-13	1.16E-04	53
rs2800789	1	C	A	0.008	0.001	3.10E-08	6.64E-05	31
rs10788958	1	G	C	0.014	0.002	1.00E-19	1.79E-04	83
rs4335354	1	A	C	-0.009	0.002	4.60E-09	7.45E-05	34
rs1884447	1	A	G	0.008	0.002	2.30E-08	6.77E-05	31
rs61818100	1	C	T	0.013	0.002	6.20E-09	7.32E-05	34
rs6433478	2	C	T	0.009	0.001	1.50E-09	7.91E-05	36
rs12473732	2	T	C	0.011	0.001	1.40E-13	1.19E-04	55
rs7571789	2	C	T	0.013	0.001	3.00E-18	1.65E-04	76
rs7575451	2	G	C	-0.010	0.002	3.80E-10	8.51E-05	39
rs1434095	2	C	T	0.014	0.002	5.30E-10	8.37E-05	39
rs17630248	2	C	T	-0.009	0.002	4.10E-09	7.50E-05	35
rs1981612	2	A	C	0.009	0.002	1.00E-09	8.09E-05	37
rs1641457	2	G	T	0.012	0.002	1.40E-11	9.90E-05	46
rs10176878	2	C	T	-0.013	0.002	8.60E-12	1.01E-04	47
rs61286123	2	C	T	-0.010	0.002	1.20E-08	7.06E-05	33
rs34030812	2	C	T	-0.010	0.002	4.10E-11	9.45E-05	44
rs10205394	2	C	G	-0.011	0.002	1.10E-09	8.06E-05	37
rs1551042	3	C	A	-0.011	0.002	7.40E-13	1.12E-04	51
rs9866627	3	A	C	-0.016	0.003	5.70E-09	7.36E-05	34
rs112485536	3	T	C	0.016	0.003	9.40E-09	7.15E-05	33
rs62253653	3	G	A	0.011	0.002	5.50E-11	9.33E-05	43
rs6802071	3	T	C	-0.009	0.002	3.80E-10	8.50E-05	39
rs71298370	3	A	G	0.015	0.003	3.80E-08	6.56E-05	30
rs13091492	3	G	A	-0.008	0.002	3.30E-08	6.63E-05	31
rs4677601	3	G	A	0.009	0.001	1.10E-09	8.07E-05	37
rs35609019	4	C	G	0.009	0.002	7.70E-10	8.21E-05	38
rs13107325	4	T	C	-0.026	0.003	1.80E-20	1.86E-04	86
rs56338231	4	G	A	-0.011	0.002	1.70E-10	8.86E-05	41
rs997850	4	C	G	-0.009	0.002	6.30E-09	7.32E-05	34
rs34722008	4	A	G	0.009	0.002	3.30E-08	6.62E-05	31
rs2850379	4	A	C	-0.008	0.002	3.30E-08	6.62E-05	31
rs75497896	4	C	T	-0.021	0.003	9.10E-10	8.14E-05	38
rs116409670	5	T	C	-0.015	0.003	2.60E-08	6.72E-05	31
rs13356200	5	G	T	-0.009	0.002	9.70E-09	7.14E-05	33
rs6882168	5	T	C	-0.009	0.002	2.80E-09	7.66E-05	35
rs113918482	5	G	A	-0.010	0.002	1.50E-08	6.94E-05	32
rs2974438	5	A	G	-0.010	0.002	3.30E-08	6.62E-05	31
rs9371201	6	T	C	-0.009	0.002	3.00E-09	7.64E-05	35
rs77485342	6	T	C	0.033	0.006	3.50E-09	7.57E-05	35
rs35175534	6	C	A	-0.016	0.002	3.60E-12	1.05E-04	48
rs2038760	6	T	C	-0.012	0.002	6.60E-09	7.30E-05	34
rs9371881	6	A	G	0.009	0.002	9.60E-10	8.11E-05	37
rs4621706	7	T	C	-0.012	0.002	6.00E-15	1.32E-04	61
rs12533765	7	G	A	-0.009	0.002	2.60E-08	6.73E-05	31
rs16870531	7	T	C	0.011	0.002	1.30E-10	8.96E-05	41
rs12673062	7	A	G	-0.011	0.002	2.60E-09	7.69E-05	35
rs73307079	7	C	T	0.011	0.002	1.40E-09	7.95E-05	37
rs6962338	7	G	A	-0.021	0.004	3.20E-09	7.60E-05	35
rs17282763	7	C	T	0.009	0.002	4.40E-08	6.50E-05	30
rs821100	8	G	A	-0.010	0.002	1.50E-09	7.93E-05	37
rs59116179	8	T	C	0.009	0.002	2.40E-08	6.75E-05	31
rs4737446	8	T	G	0.010	0.002	1.20E-10	8.98E-05	41
rs1486925	8	C	T	-0.010	0.002	6.30E-11	9.27E-05	43

rs10097417	8	G	A	-0.013	0.002	1.90E-11	9.78E-05	45
rs7026798	9	C	T	0.008	0.002	4.60E-08	6.48E-05	30
rs116922558	9	G	A	-0.022	0.004	2.10E-08	6.80E-05	31
rs2789514	9	A	G	0.012	0.002	4.90E-08	6.46E-05	30
rs10988217	9	G	A	-0.009	0.002	1.70E-09	7.86E-05	36
rs35236379	10	T	G	0.012	0.002	5.80E-09	7.35E-05	34
rs4962700	10	G	C	0.009	0.002	3.20E-08	6.64E-05	31
rs772014	10	G	A	-0.011	0.002	2.70E-12	1.06E-04	49
rs10821939	10	A	G	-0.009	0.002	4.90E-10	8.40E-05	39
rs1556659	10	T	C	0.016	0.002	2.50E-26	2.44E-04	113
rs72977282	11	A	T	-0.016	0.002	7.80E-25	2.30E-04	106
rs10831903	11	T	C	0.009	0.002	8.10E-10	8.19E-05	38
rs61389091	11	T	C	0.026	0.004	2.40E-12	1.07E-04	49
rs34845616	11	A	G	0.011	0.002	4.00E-10	8.48E-05	39
rs10846071	12	T	C	-0.017	0.002	5.30E-28	2.61E-04	120
rs11168357	12	A	G	-0.010	0.002	2.50E-08	6.75E-05	31
rs4575361	12	T	A	-0.011	0.002	1.60E-11	9.86E-05	45
rs12316046	12	G	A	-0.017	0.002	5.00E-30	2.81E-04	130
rs7963801	12	C	T	-0.010	0.002	4.60E-12	1.04E-04	48
rs56060323	13	T	C	0.009	0.002	1.50E-08	6.95E-05	32
rs12889267	14	G	A	-0.014	0.002	4.70E-12	1.04E-04	48
rs7148603	14	A	G	0.010	0.002	1.60E-09	7.90E-05	36
rs2359239	14	T	C	-0.009	0.002	6.90E-09	7.28E-05	34
rs10144445	14	G	C	-0.009	0.002	1.90E-09	7.83E-05	36
rs12906830	15	C	T	0.011	0.002	9.30E-13	1.11E-04	51
rs17466480	15	G	A	-0.012	0.002	9.80E-15	1.30E-04	60
rs12914702	15	A	G	0.011	0.002	9.30E-11	9.10E-05	42
rs7176095	15	G	A	-0.013	0.002	1.70E-09	7.87E-05	36
rs13337177	16	T	G	-0.014	0.002	1.60E-13	1.18E-04	54
rs11642954	16	A	G	-0.012	0.002	4.50E-10	8.43E-05	39
rs217181	16	T	C	0.012	0.002	2.10E-10	8.76E-05	40
rs9944324	16	G	A	-0.009	0.002	1.20E-08	7.04E-05	32
rs7197751	16	T	G	-0.009	0.002	1.40E-09	7.95E-05	37
rs3814877	16	T	G	0.011	0.002	3.40E-12	1.05E-04	48
rs11076004	16	A	G	-0.012	0.002	2.10E-14	1.27E-04	58
rs999493	17	A	G	0.013	0.002	6.20E-17	1.52E-04	70
rs2587505	17	C	T	-0.009	0.002	2.30E-09	7.74E-05	36
rs635538	18	A	G	-0.022	0.003	3.80E-16	1.44E-04	66
rs4308051	18	G	T	0.016	0.002	1.40E-18	1.68E-04	77
rs143002906	18	T	C	0.026	0.005	9.80E-09	7.13E-05	33
rs10403906	19	A	G	-0.010	0.001	1.50E-11	9.88E-05	46
rs11669079	19	T	A	0.011	0.002	1.90E-11	9.78E-05	45
rs8101782	19	C	A	0.010	0.002	2.90E-08	6.67E-05	31
rs8108461	19	C	T	0.010	0.002	2.60E-10	8.67E-05	40
rs143384	20	G	A	0.021	0.002	1.50E-43	4.15E-04	192
rs9611273	22	T	C	0.011	0.002	4.50E-10	8.43E-05	39
rs6006984	22	C	T	0.010	0.002	2.60E-09	7.69E-05	35

Chr: chromosome; EA: effect allele; NEA: non-effect allele; SE: standard error; SNP: single-nucleotide polymorphisms

Supplementary Table S4: SNPs of RHGS excluded from Mendelian randomization analysis.

Exposure	SNP ID	PhenoScanner traits
RHGS	rs58670122,rs10798483,rs6693965,rs1952256,rs823130,rs10799428, rs4121165,rs1892425,rs1550115,rs6711390,rs1840753,rs1047891, rs7652177,rs2194411,rs2362972,rs62234790,rs2341184,rs9853018, rs13146142,rs13106087,rs13107325,rs4868110,rs2431112,rs2631360, rs2322754,rs9322822,rs7451021,rs11243202,rs9267806,rs185320691,rs113315602,rs1885690,rs4549685,rs112330055,rs7790322,rs6977081, rs10278546,rs6473015,rs7871404,rs2208562,rs113851275,rs600038, rs4752689, rs12763284, rs11039348, rs10770125, rs76895963, rs10784502, rs4768725,rs3118914,rs10483727,rs2871865,rs2165241,rs1210479,rs246181,rs7196917,rs248831,rs478557	FVC/FEV1/Asthma /Peak expiratory flow/ Pulmonary Embolism/ Bronchitis/ Emphysema

4rs2854152,rs1043515,rs12452505,rs56365901,rs10520770,rs36065733,rs7266065,rs143384

Supplementary Table S5: SNPs of LHGS excluded from Mendelian randomization analysis.

Exposure	SNP ID	PhenoScanner traits
LHGS	rs1044299,rs11121542,rs4121165,rs58670122,rs823130,rs11204664, rs6689375,rs11125803,rs3819121,rs10934857,rs4498020,rs2871960, rs13146142,rs34587452,rs13106087,rs55681913,rs2431112,rs2631360rs185320691,rs12528131,rs9388769,rs113315602,rs723588,rs11243202,rs4713506,rs41271299,rs11769549,rs13227429, rs6977081, rs4398863, rs4739739, rs7856625, rs16910750, rs11002322, rs10786706, rs11003014,rs4930236, rs12790261, rs7124681, rs76895963, rs7970350, rs11111267, rs3118903, rs28542042, rs3959716,rs2871865, rs7196917, rs181766, rs113434679, rs755547, rs2532111, rs62081464, rs35054365, rs4811040	FVC/FEV1/Asthma /Peak expiratory flow/ Long-standing illness, disability or infirmity