Supplementary Tables

	For analysis	After quality control
Short-axis image	26,904	26,521 (98.6%)
Long-axis image	26,602	26,240 (98.6%)
Aortic image	26,300	25,673 (97.6%)

Supplementary Table 1. Number of subjects with available raw images for analysis and after quality control. In total, imaging phenotypes were available for 26,893 subjects after quality control.

	Women (n = 13,969)	Men (n = 12,924)
Age (year)	62.8 (7.4)	64.2 (7.6)
Race (%)		
Caucasian	97.4	96.8
Other ethnicities	2.4	2.9
Unknown	0.2	0.4
Weight (kg)	69.2 (13.1)	83.9 (13.5)
Height (cm)	162.7 (6.2)	176.1 (6.6)
BMI (kg/m^2)	26.2 (4.8)	27.0 (3.9)
SBP (mmHg)	133.9 (18.5)	140.6 (16.8)
DBP (mmHg)	77.3 (10.0)	80.9 (9.8)
Life-style		
Current smoking (%)	3.1	4.3
Alcohol intake (gram per day)	13.3 (12.3)	26.1 (22.0)
Vigorous PA (days per week)	1.8 (1.8)	2.2 (1.9)
Self-reported diseases		
Hypertension (%)	17.9	26.4
High cholesterol (%)	9.0	14.3
Cardiac disease (%)	3.9	8.8
PVD (%)	0.0	0.2
Diabetes (%)	3.1	6.3
Stroke (%)	0.8	1.3
Asthma (%)	10.1	9.3
COPD (%)	0.4	0.8
Bronchitis (%)	1.8	1.8
Parkinson's (%)	0.1	0.2
Dementia (%)	0.0	0.1
Depression (%)	9.9	5.8

Supplementary Table 2. Basic participant characteristics. n = 26,893 subjects were analysed. Values are depicted as mean (standard deviation). BMI: body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure; PA: physical activity; PVD: peripheral vascular disease; COPD: chronic obstructive pulmonary disease.

	Women (n = 13,969)	Men (n = 12,924)
Left ventricle		
LV end-diastolic volume (mL)	129.5 (22.5)	168.8 (32.1)
LV end-systolic volume (mL)	50.5 (12.6)	71.5 (19.4)
LV stroke volume (mL)	79.0 (14.4)	97.3 (19.3)
LV ejection fraction (%)	61.1 (5.6)	57.8 (6.1)
LV cardiac output (L/min)	5.0 (1.1)	5.9 (1.3)
LV myocardial mass (g)	70.9 (12.2)	102.9 (18.3)
LV wall thickness (mm)	5.2 (0.5)	6.2 (0.7)
Global peak strain E_{cc} (%)	-23.4 (3.0)	-21.1 (3.2)
Global peak strain E_{rr} (%)	47.5 (7.8)	42.2 (7.8)
Global peak strain E_{ll} (%)	-19.1 (2.7)	-17.8 (2.6)
Right ventricle		
RV end-diastolic volume (mL)	134.2 (24.3)	181.3 (33.3)
RV end-systolic volume (mL)	54.9 (13.4)	81.4 (19.4)
RV stroke volume (mL)	79.3 (15.1)	99.9 (20.0)
RV ejection fraction (%)	59.3 (5.7)	55.2 (5.9)
Left atrium		
LA maximal volume (mL)	67.6 (19.2)	78.7 (25.8)
LA minimal volume (mL)	26.5 (12.0)	32.4 (17.9)
LA stroke volume (mL)	41.1 (10.1)	46.3 (12.7)
LA ejection fraction (%)	61.9 (8.6)	60.5 (9.7)
Right atrium		
RA maximal volume (mL)	75.2 (19.5)	97.8 (29.8)
RA minimal volume (mL)	38.1 (12.5)	54.7 (20.8)
RA stroke volume (mL)	37.1 (11.1)	43.1 (14.4)
RA ejection fraction (%)	49.5 (8.8)	44.6 (9.0)
Ascending aorta		
AAo maximal area (mm^2)	775.9 (156.0)	925.3 (189.5)
AAo minimal area (mm^2)	703.3 (155.1)	841.8 (185.9)
AAo distensibility (10^{-3} $mmHg^{-1}$)	1.9 (1.5)	1.9 (1.2)
Descending aorta		
DAo maximal area (mm^2)	421.4 (71.0)	529.5 (91.6)
DAo minimal area (mm^2)	368.3 (68.3)	468.2 (87.3)
DAo distensibility (10^{-3} $mmHg^{-1}$)	2.5 (1.7)	2.5 (1.4)

Supplementary Table 3. Statistics of global imaging phenotypes for the heart and aorta. n = 26,893 subjects were analysed. The values are depicted as mean (standard deviation).

Segment		Women (n = 13,969)	Men (n = 12,924)
		Wall thickness (mm)	Wall thickness (mm)
Basal	1	6.1 (0.9)	7.2 (1.1)
	2	4.6 (1.0)	5.3 (1.2)
	3	4.9 (1.0)	5.7 (1.1)
	4	5.6 (0.8)	6.8 (1.0)
	5	5.8 (0.7)	6.8 (0.8)
	6	5.8 (0.7)	6.8 (0.9)
Mid	7	5.1 (0.6)	6.2 (0.8)
	8	5.7 (0.7)	6.9 (0.9)
	9	5.9 (0.8)	7.2 (1.0)
	10	5.4 (0.7)	6.6 (0.8)
	11	5.2 (0.6)	6.2 (0.8)
	12	5.1 (0.6)	6.1 (0.8)
Apical	13	4.2 (0.6)	5.1 (0.7)
	14	4.4 (0.6)	5.3 (0.7)
	15	4.1 (0.6)	5.0 (0.7)
	16	4.3 (0.6)	5.2 (0.7)
Global		5.2 (0.5)	6.2 (0.7)

Supplementary Table 4. Statistics of regional and global myocardial wall thickness. n = 26,893 subjects were analysed. The values are depicted as mean (standard deviation).

Segment		Women (n = 13,969)		Men (n = 12,924)	
		E_{cc} (%)	E_{rr} (%)	E_{cc} (%)	E_{rr} (%)
Basal	1	-23.9 (5.2)	39.3 (12.9)	-22.3 (5.3)	35.5 (12.8)
	2	-23.9 (6.6)	30.6 (11.6)	-18.2 (6.9)	24.6 (11.2)
	3	-20.3 (6.1)	35.6 (13.2)	-19.0 (5.2)	27.4 (13.0)
	4	-19.0 (5.9)	62.7 (17.8)	-19.1 (5.4)	51.4 (16.0)
	5	-27.6 (5.2)	67.6 (16.2)	-25.0 (5.3)	60.1 (14.3)
	6	-27.1 (5.5)	56.3 (18.7)	-26.0 (5.1)	53.9 (16.7)
Mid	7	-27.9 (5.3)	52.8 (13.2)	-24.7 (5.2)	47.2 (12.6)
	8	-27.3 (5.5)	43.7 (10.6)	-24.8 (5.4)	40.5 (10.3)
	9	-23.5 (7.2)	49.3 (12.1)	-21.8 (5.8)	44.3 (11.1)
	10	-15.6 (5.0)	51.0 (14.0)	-15.5 (4.6)	45.4 (12.4)
	11	-22.9 (5.4)	57.1 (12.7)	-20.7 (5.3)	50.5 (11.4)
	12	-20.3 (5.2)	53.6 (12.9)	-18.0 (4.8)	46.7 (12.1)
Apical	13	-30.1 (5.7)	49.9 (13.5)	-27.0 (5.9)	47.2 (13.6)
	14	-30.9 (5.8)	44.3 (12.6)	-28.5 (5.8)	41.8 (13.0)
	15	-23.4 (6.5)	58.0 (14.5)	-23.8 (6.5)	53.5 (14.0)
	16	-26.1 (5.7)	58.0 (13.5)	-24.9 (6.0)	54.7 (13.4)
Global		-23.4 (3.0)	47.5 (7.8)	-21.1 (3.2)	42.2 (7.8)

Supplementary Table 5. Statistics of regional and global peak circumferential strain E_{cc} and peak radial strain E_{rr}. n = 26,893 subjects were analysed. The values are depicted as mean (standard deviation).

Segment		Women (n = 13,969)	Men (n = 12,924)
		E_{ll} (%)	E_{ll} (%)
Basal	1	-27.3 (7.2)	-27.1 (6.7)
	2	-32.6 (7.8)	-32.2 (7.0)
Mid	3	-14.3 (5.0)	-12.5 (4.9)
	4	-18.4 (5.6)	-15.1 (5.2)
Apical	5	-11.1 (4.6)	-10.6 (4.5)
	6	-17.2 (4.7)	-15.5 (4.9)
Global		-19.1 (2.7)	-17.8 (2.6)

Supplementary Table 6. Statistics of regional and global peak longitudinal strain E_{ll}. n = 26,893 subjects were analysed. The values are depicted as mean (standard deviation).

	LVM (g)	LVEDV (mL)	LVEF (%)	RVEDV (mL)	RVEF (%)
Sex	$53.0_{[49.8,56.3]}$ ($p=3\times10^{-218}$)	$53.1_{[47.4,58.8]}$ ($p=2.9\times10^{-74}$)	$-3.2_{[-3.4,-3.1]}$ ($p=10^{-324}$)	$71.1_{[65.0,77.2]}$ ($p=7.7\times10^{-116}$)	$-4.1_{[-4.2,-3.9]}$ ($p=10^{-324}$)
Age, per 7.5 yr	$-1.0_{[-1.2,-0.7]}$ ($p=2.2\times10^{-12}$)	$-5.9_{[-6.4,-5.5]}$ ($p=2.5\times10^{-136}$)	$0.3_{[0.3,0.4]}$ ($p=1.1\times10^{-19}$)	$-6.1_{[-6.6,-5.7]}$ ($p=4.7\times10^{-130}$)	$0.5_{[0.4,0.6]}$ ($p=1.6\times10^{-37}$)
Sex * Age, per 7.5 yr	$-2.4_{[-2.8,-2.1]}$ ($p=5.6\times10^{-36}$)	$-1.5_{[-2.2,-0.8]}$ ($p=8.6\times10^{-6}$)		$-2.6_{[-3.3,-1.9]}$ ($p=4.6\times10^{-13}$)	
	LAV max (mL)	**LAEF (%)**	**RAV max (mL)**	**RAEF (%)**	
Sex	$10.6_{[10.1,11.2]}$ ($p=2.6\times10^{-297}$)	$-0.9_{[-1.1,-0.7]}$ ($p=1.7\times10^{-15}$)	$22.7_{[22.1,23.3]}$ ($p=10^{-324}$)	$-8.9_{[-10.8,-7.0]}$ ($p=1.4\times10^{-19}$)	
Age, per 7.5 yr	$-2.0_{[-2.3,-1.7]}$ ($p=9.1\times10^{-44}$)	$-0.8_{[-0.9,-0.7]}$ ($p=2.3\times10^{-43}$)	$-1.0_{[-1.3,-0.7]}$ ($p=1.7\times10^{-9}$)	$-0.2_{[-0.4,-0.1]}$ ($p=0.003$)	
Sex * Age, per 7.5 yr				$0.5_{[0.3,0.7]}$ ($p=2.3\times10^{-5}$)	
	AAo max area (mm^2)	**AAo distensibility**	**DAo max area (mm^2)**	**DAo distensibility**	
Sex	$143.9_{[139.5,148.3]}$ ($p=10^{-324}$)	$-0.9_{[-1.2,-0.6]}$ ($p=2.1\times10^{-10}$)	$104.9_{[102.8,106.9]}$ ($p=10^{-324}$)	$-1.1_{[-1.5,-0.8]}$ ($p=1.7\times10^{-10}$)	
Age, per 7.5 yr	$29.3_{[27.1,31.5]}$ ($p=6.1\times10^{-146}$)	$-0.7_{[-0.7,-0.7]}$ ($p=10^{-324}$)	$20.8_{[19.8,21.9]}$ ($p=10^{-324}$)	$-0.8_{[-0.8,-0.7]}$ ($p=10^{-324}$)	
Sex * Age, per 7.5 yr		$0.1_{[0.1,0.2]}$ ($p=8.4\times10^{-14}$)		$0.1_{[0.1,0.2]}$ ($p=10^{-11}$)	

Supplementary Table 7. Associations of selected imaging phenotypes with sex and age. After excluding non-Caucasian subjects and subjects with CVDs, n = 23,415 subjects were included in the analysis. The values are depicted as regression coefficient β [95% confidence interval] (two-sided t-test p-value). For continuous variables, the coefficient describes the effect per standard deviation of the variable. For binary variables, the coefficient describes the effect with a change in the variable from 0 to 1. Female is coded as 0.

	LVM (g)	LVEDV (mL)	LVEF (%)	RVEDV (mL)	RVEF (%)
Sex	$30.2_{[27.4,33.0]}$ ($p=10^{-96}$)	$22.5_{[17.0,28.0]}$ ($p=10^{-15}$)	$-2.5_{[-2.8,-2.3]}$ ($p=3.6\times10^{-89}$)	$41.5_{[35.6,47.4]}$ ($p=3.2\times10^{-43}$)	$-3.7_{[-3.9,-3.5]}$ ($p=3.7\times10^{-193}$)
Age, per 7.5 yr	$-1.2_{[-1.4,-0.9]}$ ($p=8\times10^{-20}$)	$-5.2_{[-5.6,-4.7]}$ ($p=2.3\times10^{-94}$)	$-0.0_{[-0.1,0.1]}$ ($p=0.903$)	$-4.2_{[-4.7,-3.7]}$ ($p=3.6\times10^{-56}$)	$-0.1_{[-0.1,0.0]}$ ($p=0.250$)
Sex * Age, per 7.5 yr	$-1.6_{[-1.9,-1.3]}$ ($p=4\times10^{-22}$)	$-0.9_{[-1.5,-0.3]}$ ($p=0.006$)		$-2.2_{[-2.9,-1.5]}$ ($p=2.7\times10^{-10}$)	
Weight, per 15.1 kg	$8.2_{[8.0,8.4]}$ ($p=10^{-324}$)	$8.4_{[8.0,8.8]}$ ($p=10^{-324}$)	$0.1_{[0.0,0.2]}$ ($p=0.035$)	$9.2_{[8.8,9.7]}$ ($p=10^{-324}$)	$-0.4_{[-0.5,-0.3]}$ ($p=1.6\times10^{-12}$)
Height, per 9.2 cm	$3.8_{[3.5,4.0]}$ ($p=3.5\times10^{-172}$)	$10.7_{[10.2,11.2]}$ ($p=10^{-324}$)	$-0.5_{[-0.7,-0.4]}$ ($p=2\times10^{-16}$)	$11.2_{[10.6,11.7]}$ ($p=10^{-324}$)	$-0.1_{[-0.3,-0.0]}$ ($p=0.029$)
SBP, per 18.0 mmHg	$4.8_{[4.6,5.1]}$ ($p=10^{-324}$)	$5.8_{[5.3,6.3]}$ ($p=2.4\times10^{-130}$)	$0.9_{[0.8,1.0]}$ ($p=4.9\times10^{-49}$)	$3.0_{[2.5,3.5]}$ ($p=4.8\times10^{-32}$)	$1.6_{[1.5,1.7]}$ ($p=1.4\times10^{-161}$)
DBP, per 10.0 mmHg	$-1.4_{[-1.7,-1.2]}$ ($p=5.5\times10^{-35}$)	$-5.4_{[-5.8,-4.9]}$ ($p=1.1\times10^{-120}$)	$-0.7_{[-0.8,-0.6]}$ ($p=5.8\times10^{-38}$)	$-4.3_{[-4.8,-3.8]}$ ($p=4.3\times10^{-68}$)	$-0.8_{[-0.9,-0.7]}$ ($p=1.3\times10^{-45}$)
Smoking status	$2.4_{[1.5,3.2]}$ ($p=6.7\times10^{-8}$)	$-1.3_{[-3.0,0.3]}$ ($p=0.118$)	$-0.4_{[-0.9,-0.0]}$ ($p=0.037$)	$-4.4_{[-6.2,-2.6]}$ ($p=1.2\times10^{-6}$)	$-0.4_{[-0.8,0.1]}$ ($p=0.086$)
Alcohol, per 18.7 g/d	$1.0_{[0.8,1.1]}$ ($p=3.4\times10^{-27}$)	$1.4_{[1.1,1.8]}$ ($p=7.7\times10^{-17}$)	$-0.0_{[-0.1,0.0]}$ ($p=0.364$)	$1.1_{[0.7,1.5]}$ ($p=3.9\times10^{-9}$)	$0.0_{[-0.1,0.1]}$ ($p=0.472$)
PA, per 1.9 d/w	$2.1_{[1.9,2.3]}$ ($p=6.4\times10^{-132}$)	$4.3_{[3.9,4.6]}$ ($p=7.1\times10^{-144}$)	$-0.2_{[-0.2,-0.1]}$ ($p=1.1\times10^{-4}$)	$4.7_{[4.3,5.0]}$ ($p=2.1\times10^{-150}$)	$-0.2_{[-0.3,-0.1]}$ ($p=3.2\times10^{-8}$)
High cholesterol	$-0.4_{[-0.9,0.1]}$ ($p=0.138$)	$-2.8_{[-3.9,-1.8]}$ ($p=7.4\times10^{-8}$)	$0.2_{[-0.1,0.4]}$ ($p=0.230$)	$-2.9_{[-4.0,-1.8]}$ ($p=3.5\times10^{-7}$)	$0.3_{[0.0,0.5]}$ ($p=0.046$)
Diabetes	$-1.0_{[-1.8,-0.1]}$ ($p=0.025$)	$-8.7_{[-10.3,-7.0]}$ ($p=1.4\times10^{-24}$)	$-1.0_{[-1.4,-0.5]}$ ($p=5.1\times10^{-6}$)	$-11.1_{[-12.9,-9.3]}$ ($p=3.4\times10^{-34}$)	$-0.7_{[-1.1,-0.3]}$ ($p=5\times10^{-4}$)

	LAV max (mL)	LAEF (%)	RAV max (mL)	RAEF (%)
Sex	$-1.0_{[-1.8,-0.1]}$ ($p=0.033$)	$0.7_{[0.4,1.1]}$ ($p=1.1\times10^{-4}$)	$9.0_{[8.0,10.0]}$ ($p=8.2\times10^{-67}$)	$-8.7_{[-10.7,-6.6]}$ ($p=5.4\times10^{-16}$)
Age, per 7.5 yr	$-2.3_{[-2.6,-1.9]}$ ($p=7.2\times10^{-43}$)	$-1.0_{[-1.1,-0.8]}$ ($p=1.4\times10^{-43}$)	$0.8_{[0.4,1.1]}$ ($p=5.6\times10^{-5}$)	$-0.7_{[-0.9,-0.5]}$ ($p=2.1\times10^{-13}$)
Sex * Age, per 7.5 yr				$0.6_{[0.3,0.8]}$ ($p=2\times10^{-6}$)
Weight, per 15.1 kg	$7.8_{[7.4,8.2]}$ ($p=10^{-324}$)	$-0.9_{[-1.1,-0.8]}$ ($p=3.2\times10^{-31}$)	$-0.4_{[-0.8,0.0]}$ ($p=0.078$)	$0.1_{[-0.1,0.2]}$ ($p=0.344$)
Height, per 9.2 cm	$1.8_{[1.4,2.3]}$ ($p=4.1\times10^{-15}$)	$-0.4_{[-0.6,-0.2]}$ ($p=1.8\times10^{-5}$)	$9.7_{[9.1,10.2]}$ ($p=2.8\times10^{-280}$)	$-0.9_{[-1.1,-0.7]}$ ($p=1.5\times10^{-18}$)
SBP, per 18.0 mmHg	$4.8_{[4.4,5.3]}$ ($p=8.3\times10^{-115}$)	$-0.0_{[-0.2,0.1]}$ ($p=0.647$)	$-0.1_{[-0.6,0.4]}$ ($p=0.713$)	$0.9_{[0.7,1.0]}$ ($p=3.9\times10^{-21}$)
DBP, per 10.0 mmHg	$-4.1_{[-4.5,-3.7]}$ ($p=1.7\times10^{-88}$)	$0.5_{[0.3,0.6]}$ ($p=8.9\times10^{-8}$)	$-1.5_{[-2.0,-1.1]}$ ($p=6.6\times10^{-11}$)	$0.0_{[-0.1,0.2]}$ ($p=0.738$)
Smoking status	$-3.5_{[-5.0,-2.1]}$ ($p=2.9\times10^{-6}$)	$-0.2_{[-0.9,0.4]}$ ($p=0.436$)	$-5.4_{[-7.1,-3.7]}$ ($p=5.3\times10^{-10}$)	$0.1_{[-0.6,0.7]}$ ($p=0.835$)
Alcohol, per 18.7 g/d	$1.1_{[0.8,1.4]}$ ($p=4.5\times10^{-13}$)	$-0.2_{[-0.3,-0.1]}$ ($p=0.003$)	$0.6_{[0.2,0.9]}$ ($p=7.6\times10^{-4}$)	$-0.1_{[-0.3,-0.0]}$ ($p=0.035$)
PA, per 1.9 d/w	$2.6_{[2.3,2.9]}$ ($p=9.7\times10^{-69}$)	$-0.4_{[-0.5,-0.2]}$ ($p=3.4\times10^{-9}$)	$3.1_{[2.8,3.4]}$ ($p=3.9\times10^{-74}$)	$-0.5_{[-0.7,-0.4]}$ ($p=1.8\times10^{-17}$)
High cholesterol	$-1.7_{[-2.6,-0.8]}$ ($p=3.7\times10^{-4}$)	$0.3_{[-0.1,0.7]}$ ($p=0.111$)	$-3.3_{[-4.3,-2.2]}$ ($p=1.6\times10^{-9}$)	$0.3_{[-0.1,0.7]}$ ($p=0.196$)
Diabetes	$-3.5_{[-5.0,-2.1]}$ ($p=2.6\times10^{-6}$)	$-1.1_{[-1.7,-0.4]}$ ($p=9.3\times10^{-4}$)	$-7.2_{[-8.9,-5.5]}$ ($p=1.1\times10^{-16}$)	$-0.0_{[-0.6,0.6]}$ ($p=0.960$)

	AAo max area (mm^2)	AAo distensibility	DAo max area (mm^2)	DAo distensibility
Sex	$42.2_{[35.2,49.2]}$ ($p=8.7\times10^{-32}$)	$-0.6_{[-0.9,-0.2]}$ ($p=5.5\times10^{-4}$)	$49.1_{[45.9,52.2]}$ ($p=2.5\times10^{-197}$)	$-0.7_{[-1.0,-0.3]}$ ($p=7\times10^{-4}$)
Age, per 7.5 yr	$44.0_{[41.4,46.6]}$ ($p=3.7\times10^{-241}$)	$-0.7_{[-0.7,-0.6]}$ ($p=10^{-324}$)	$27.2_{[26.0,28.3]}$ ($p=10^{-324}$)	$-0.7_{[-0.7,-0.6]}$ ($p=10^{-324}$)
Sex * Age, per 7.5 yr		$0.1_{[0.1,0.1]}$ ($p=3.9\times10^{-8}$)		$0.1_{[0.1,0.1]}$ ($p=6.7\times10^{-6}$)
Weight, per 15.1 kg	$36.6_{[33.6,39.6]}$ ($p=1.8\times10^{-122}$)	$0.0_{[0.0,0.1]}$ ($p=2.4\times10^{-4}$)	$26.2_{[24.9,27.6]}$ ($p=1.6\times10^{-300}$)	$-0.0_{[-0.1,-0.0]}$ ($p=0.023$)
Height, per 9.2 cm	$29.5_{[25.9,33.1]}$ ($p=2.2\times10^{-57}$)	$-0.1_{[-0.1,-0.0]}$ ($p=1.5\times10^{-5}$)	$14.3_{[12.7,16.0]}$ ($p=3.2\times10^{-66}$)	$0.0_{[-0.0,0.1]}$ ($p=0.335$)
SBP, per 18.0 mmHg	$-13.5_{[-16.8,-10.2]}$ ($p=1.2\times10^{-15}$)	$-0.2_{[-0.2,-0.2]}$ ($p=1.1\times10^{-41}$)	$-0.2_{[-1.7,1.3]}$ ($p=0.783$)	$-0.3_{[-0.3,-0.2]}$ ($p=2.9\times10^{-53}$)
DBP, per 10.0 mmHg	$40.5_{[37.3,43.6]}$ ($p=2.4\times10^{-135}$)	$-0.1_{[-0.1,-0.1]}$ ($p=2.2\times10^{-15}$)	$10.8_{[9.4,12.3]}$ ($p=2.5\times10^{-49}$)	$-0.1_{[-0.1,-0.0]}$ ($p=1.9\times10^{-6}$)
Smoking status	$10.3_{[-1.6,22.2]}$ ($p=0.090$)	$0.0_{[-0.1,0.1]}$ ($p=0.636$)	$14.5_{[9.1,19.9]}$ ($p=1.3\times10^{-7}$)	$0.1_{[-0.0,0.2]}$ ($p=0.054$)
Alcohol, per 18.7 g/d	$11.7_{[9.3,14.1]}$ ($p=1.6\times10^{-21}$)	$-0.0_{[-0.0,0.0]}$ ($p=0.076$)	$4.4_{[3.3,5.4]}$ ($p=3.3\times10^{-15}$)	$-0.0_{[-0.1,-0.0]}$ ($p=0.010$)
PA, per 1.9 d/w	$10.5_{[8.2,12.8]}$ ($p=5.2\times10^{-19}$)	$0.0_{[0.0,0.1]}$ ($p=1.5\times10^{-5}$)	$6.3_{[5.3,7.4]}$ ($p=4.9\times10^{-33}$)	$0.0_{[0.0,0.1]}$ ($p=5.9\times10^{-5}$)
High cholesterol	$-0.0_{[-7.3,7.3]}$ ($p=0.998$)	$-0.0_{[-0.1,0.1]}$ ($p=0.955$)	$-5.1_{[-8.3,-1.8]}$ ($p=0.003$)	$-0.0_{[-0.1,0.1]}$ ($p=0.799$)
Diabetes	$-19.7_{[-31.5,-7.9]}$ ($p=0.001$)	$0.0_{[-0.1,0.1]}$ ($p=0.991$)	$-17.6_{[-22.9,-12.3]}$ ($p=8.9\times10^{-11}$)	$-0.1_{[-0.2,0.1]}$ ($p=0.317$)

Supplementary Table 8. Associations of imaging phenotypes with cardiovascular risk factors. n = 19,988 subjects were analysed with available information for all independent variables. The values are depicted as regression coefficient β [95% confidence interval] (two-sided t-test p-value). Independent variables include sex, age, weight, height, systolic blood pressure (SBP), diastolic blood pressure (DBP), current smoking status, alcohol intake, vigorous physical activity (PA) frequency, high cholesterol, diabetes. For continuous variables, the coefficient describes the effect per standard deviation of the variable. For binary variables, the coefficient describes the effect with a change in the variable from 0 to 1. Female is coded as 0.

Category	Code	Meaning
Hypertension	1065	Hypertension
	1072	Essential hypertension
	1073	Gestational hypertension/pre-eclampsia
High cholesterol	1473	High cholesterol
Cardiac disease	1066	Heart/cardiac problem
	1074	Angina
	1075	Heart attack/myocardial infarction
	1076	Heart failure/pulmonary odema
	1077	Heart arrhythmia
	1471	Atrial fibrillation
	1483	Atrial flutter
	1484	Wolff Parkinson white/WPW syndrome
	1485	Irregular heart beat
	1486	Sick sinus syndrome
	1487	SVT/supraventricular tachycardia
	1078	Heart valve problem/heart murmur
	1584	Mitral valve disease
	1585	Mitral regurgitation/incompetence
	1586	Aortic valve disease
	1587	Aortic regurgitation/incompetence
	1079	Cardiomyopathy
	1588	Hypertrophic cardiomyopathy (HCM/HOCM)
	1080	Pericardial problem
	1589	Pericarditis
	1590	Pericardial effusion
PVD	1067	Peripheral vascular disease
	1087	Leg claudication/intermittent claudication
	1088	Arterial embolism
	1492	Aortic aneurysm
	1591	Aortic aneurysm rupture
	1592	Aortic dissection
Diabetes	1220	Diabetes
	1221	Gestational diabetes
	1222	Type 1 diabetes
	1223	Type 2 diabetes
Stroke	1081	Stroke
	1086	Subarachnoid haemorrhage
	1491	Brain haemorrhage
	1583	Ischaemic stroke
Asthma	1111	Asthma
COPD	1112	Chronic obstructive airways disease/COPD
Bronchitis	1113	Emphysema/chronic bronchitis
	1412	Bronchitis
	1472	Emphysema
	1496	Alpha-1 antitrypsin deficiency
Parkinson's	1262	Parkinson's disease
Dementia	1263	Dementia/Alzheimer's/cognitive impairment
Depression	1286	Depression
	1531	Post-natal depression

Supplementary Table 9. Categories of common diseases in participants. Defined by self-reported disease code (UK Biobank field ID 20002).

	LVM per 22.2 g	**LVEDV** per 33.8 mL	**LVEF** per 6.1 %	**RVEDV** per 37.3 mL	**RVEF** per 6.1 %
Hypertension	$1.66_{[1.58,1.75]}$ (p=3×10^{-84})	$1.05_{[1.01,1.09]}$ (p=0.024)	$1.10_{[1.07,1.13]}$ (p=2×10^{-10})	$0.96_{[0.92,1.00]}$ (p=0.072)	$1.14_{[1.11,1.18]}$ (p=6.2×10^{-17})
High cholesterol	$0.97_{[0.91,1.03]}$ (p=0.361)	$0.87_{[0.82,0.92]}$ (p=2.1×10^{-7})	$1.00_{[0.96,1.03]}$ (p=0.869)	$0.86_{[0.82,0.91]}$ (p=4×10^{-7})	$1.01_{[0.97,1.05]}$ (p=0.534)
Cardiac disease	$1.41_{[1.31,1.53]}$ (p=1.8×10^{-19})	$1.44_{[1.36,1.53]}$ (p=8.3×10^{-33})	$0.76_{[0.72,0.79]}$ (p=4.2×10^{-35})	$1.10_{[1.03,1.18]}$ (p=0.008)	$0.84_{[0.80,0.88]}$ (p=8.1×10^{-14})
PVD	$1.34_{[0.81,2.21]}$ (p=0.253)	$1.44_{[1.01,2.04]}$ (p=0.044)	$0.80_{[0.59,1.09]}$ (p=0.152)	$1.07_{[0.65,1.76]}$ (p=0.782)	$0.81_{[0.58,1.11]}$ (p=0.186)
Diabetes	$0.94_{[0.86,1.03]}$ (p=0.210)	$0.66_{[0.61,0.72]}$ (p=1.8×10^{-22})	$0.90_{[0.86,0.95]}$ (p=1.8×10^{-4})	$0.56_{[0.52,0.62]}$ (p=1.3×10^{-37})	$0.94_{[0.89,0.99]}$ (p=0.028)
Stroke	$0.97_{[0.79,1.17]}$ (p=0.724)	$0.91_{[0.78,1.07]}$ (p=0.259)	$0.94_{[0.84,1.04]}$ (p=0.228)	$0.82_{[0.69,0.97]}$ (p=0.024)	$0.90_{[0.80,1.00]}$ (p=0.056)
Asthma	$1.03_{[0.96,1.10]}$ (p=0.482)	$0.95_{[0.90,1.01]}$ (p=0.074)	$0.99_{[0.95,1.03]}$ (p=0.527)	$0.90_{[0.85,0.96]}$ (p=8.7×10^{-4})	$1.04_{[1.00,1.09]}$ (p=0.044)
COPD	$0.99_{[0.78,1.27]}$ (p=0.963)	$0.69_{[0.55,0.86]}$ (p=8.8×10^{-4})	$0.88_{[0.77,1.01]}$ (p=0.069)	$0.54_{[0.42,0.68]}$ (p=2.2×10^{-7})	$0.85_{[0.74,0.98]}$ (p=0.021)
Bronchitis	$0.95_{[0.81,1.12]}$ (p=0.565)	$0.83_{[0.72,0.94]}$ (p=0.005)	$0.90_{[0.83,0.98]}$ (p=0.019)	$0.78_{[0.68,0.89]}$ (p=3.9×10^{-4})	$0.92_{[0.85,1.01]}$ (p=0.075)
Parkinson's	$0.64_{[0.37,1.12]}$ (p=0.117)	$1.02_{[0.69,1.51]}$ (p=0.916)	$1.20_{[0.89,1.62]}$ (p=0.235)	$1.13_{[0.73,1.73]}$ (p=0.583)	$1.14_{[0.83,1.55]}$ (p=0.413)
Dementia	$0.25_{[0.08,0.82]}$ (p=0.023)	$0.41_{[0.17,0.99]}$ (p=0.048)	$0.97_{[0.58,1.62]}$ (p=0.899)	$0.47_{[0.19,1.13]}$ (p=0.090)	$1.09_{[0.63,1.91]}$ (p=0.751)
Depression	$0.97_{[0.90,1.06]}$ (p=0.517)	$0.93_{[0.87,1.00]}$ (p=0.046)	$0.98_{[0.93,1.02]}$ (p=0.279)	$0.89_{[0.83,0.96]}$ (p=0.001)	$1.01_{[0.96,1.06]}$ (p=0.693)

	LAV max per 23.2 mL	**LAEF** per 9.1 %	**RAV max** per 27.4 mL	**RAEF** per 9.2 %
Hypertension	$1.10_{[1.07,1.14]}$ (p=6.5×10^{-10})	$0.99_{[0.96,1.02]}$ (p=0.362)	$0.92_{[0.89,0.95]}$ (p=9.3×10^{-7})	$1.12_{[1.08,1.15]}$ (p=8.8×10^{-13})
High cholesterol	$0.92_{[0.88,0.96]}$ (p=3.8×10^{-5})	$1.01_{[0.97,1.04]}$ (p=0.758)	$0.88_{[0.84,0.92]}$ (p=2.1×10^{-8})	$1.00_{[0.96,1.04]}$ (p=0.914)
Cardiac disease	$1.49_{[1.42,1.56]}$ (p=1.5×10^{-63})	$0.61_{[0.58,0.63]}$ (p=2.3×10^{-107})	$1.28_{[1.22,1.34]}$ (p=2.2×10^{-22})	$0.71_{[0.67,0.74]}$ (p=1.8×10^{-38})
PVD	$1.20_{[0.89,1.61]}$ (p=0.230)	$0.70_{[0.52,0.94]}$ (p=0.017)	$1.32_{[1.01,1.72]}$ (p=0.041)	$0.82_{[0.56,1.19]}$ (p=0.300)
Diabetes	$0.87_{[0.82,0.92]}$ (p=6.3×10^{-6})	$0.92_{[0.87,0.97]}$ (p=0.002)	$0.68_{[0.64,0.73]}$ (p=1.8×10^{-25})	$1.01_{[0.95,1.07]}$ (p=0.808)
Stroke	$1.01_{[0.90,1.14]}$ (p=0.873)	$0.86_{[0.78,0.96]}$ (p=0.005)	$0.93_{[0.82,1.07]}$ (p=0.313)	$0.84_{[0.75,0.95]}$ (p=0.005)
Asthma	$0.92_{[0.88,0.96]}$ (p=3.7×10^{-4})	$1.06_{[1.02,1.11]}$ (p=0.003)	$0.93_{[0.89,0.98]}$ (p=0.004)	$1.07_{[1.02,1.11]}$ (p=0.003)
COPD	$0.77_{[0.64,0.92]}$ (p=0.004)	$0.87_{[0.76,1.00]}$ (p=0.056)	$0.73_{[0.60,0.89]}$ (p=0.001)	$1.07_{[0.92,1.25]}$ (p=0.382)
Bronchitis	$0.90_{[0.81,1.00]}$ (p=0.050)	$0.87_{[0.80,0.94]}$ (p=7.9×10^{-4})	$0.77_{[0.69,0.86]}$ (p=7.6×10^{-6})	$1.00_{[0.91,1.10]}$ (p=0.969)
Parkinson's	$1.17_{[0.90,1.50]}$ (p=0.234)	$1.10_{[0.83,1.45]}$ (p=0.507)	$1.16_{[0.88,1.54]}$ (p=0.284)	$1.51_{[1.16,1.95]}$ (p=0.002)
Dementia	$0.77_{[0.40,1.47]}$ (p=0.422)	$0.80_{[0.50,1.27]}$ (p=0.341)	$0.65_{[0.32,1.32]}$ (p=0.231)	$1.03_{[0.59,1.78]}$ (p=0.920)
Depression	$0.94_{[0.89,0.99]}$ (p=0.019)	$0.99_{[0.95,1.04]}$ (p=0.795)	$0.92_{[0.87,0.97]}$ (p=0.002)	$0.99_{[0.95,1.04]}$ (p=0.801)

	AAo max area per 188.4 mm^2	**AAo distensibility** per 1.4×10^{-3} $mmHg^{-1}$	**DAo max area** per 97.8 mm^2	**DAo distensibility** per 1.6×10^{-3} $mmHg^{-1}$
Hypertension	$1.32_{[1.27,1.36]}$ (p=4.6×10^{-55})	$0.74_{[0.70,0.78]}$ (p=6.6×10^{-30})	$1.20_{[1.15,1.25]}$ (p=1.3×10^{-19})	$0.80_{[0.76,0.84]}$ (p=6.6×10^{-20})
High cholesterol	$0.98_{[0.94,1.02]}$ (p=0.375)	$0.92_{[0.87,0.98]}$ (p=0.006)	$0.90_{[0.85,0.94]}$ (p=2.9×10^{-5})	$0.94_{[0.89,0.99]}$ (p=0.022)
Cardiac disease	$1.07_{[1.02,1.14]}$ (p=0.012)	$1.05_{[0.98,1.11]}$ (p=0.164)	$0.93_{[0.88,1.00]}$ (p=0.036)	$1.03_{[0.97,1.10]}$ (p=0.332)
PVD	$0.63_{[0.39,1.03]}$ (p=0.065)	$1.03_{[0.64,1.66]}$ (p=0.913)	$0.95_{[0.59,1.52]}$ (p=0.836)	$1.24_{[0.95,1.63]}$ (p=0.115)
Diabetes	$0.79_{[0.74,0.85]}$ (p=1.8×10^{-10})	$0.93_{[0.86,1.01]}$ (p=0.080)	$0.71_{[0.66,0.77]}$ (p=3.7×10^{-17})	$0.88_{[0.81,0.96]}$ (p=0.005)
Stroke	$0.98_{[0.85,1.12]}$ (p=0.764)	$0.98_{[0.83,1.15]}$ (p=0.762)	$0.93_{[0.80,1.08]}$ (p=0.334)	$0.89_{[0.74,1.07]}$ (p=0.201)
Asthma	$0.95_{[0.90,1.00]}$ (p=0.038)	$1.01_{[0.96,1.06]}$ (p=0.724)	$0.89_{[0.84,0.95]}$ (p=1.2×10^{-4})	$0.99_{[0.94,1.04]}$ (p=0.600)
COPD	$0.92_{[0.76,1.10]}$ (p=0.357)	$1.04_{[0.85,1.27]}$ (p=0.680)	$0.87_{[0.71,1.07]}$ (p=0.182)	$1.10_{[0.93,1.31]}$ (p=0.260)
Bronchitis	$0.88_{[0.79,0.98]}$ (p=0.025)	$0.96_{[0.85,1.08]}$ (p=0.505)	$0.94_{[0.83,1.06]}$ (p=0.304)	$0.99_{[0.88,1.10]}$ (p=0.794)
Parkinson's	$1.00_{[0.71,1.42]}$ (p=0.997)	$0.88_{[0.53,1.46]}$ (p=0.610)	$0.94_{[0.64,1.39]}$ (p=0.770)	$1.04_{[0.71,1.52]}$ (p=0.844)
Dementia	$1.02_{[0.55,1.91]}$ (p=0.944)	$0.58_{[0.18,1.91]}$ (p=0.372)	$1.09_{[0.55,2.16]}$ (p=0.803)	$0.58_{[0.18,1.87]}$ (p=0.362)
Depression	$0.97_{[0.92,1.02]}$ (p=0.221)	$1.02_{[0.97,1.07]}$ (p=0.519)	$0.96_{[0.90,1.02]}$ (p=0.195)	$1.01_{[0.96,1.06]}$ (p=0.614)

Supplementary Table 10. Associations of cardiac and aortic imaging phenotypes with common diseases. The odds ratio of each imaging phenotype as a risk factor for a common disease as outcome is reported. Sex, age, weight and height were adjusted in logistic regression. n = 25,743 subjects were analysed with available disease information. The values are depicted as odds ratio [95% confidence interval] (two-sided t-test p-value).

Structure	$-\log_{10}(p)$	r	Imaging phenotype	Non-imaging phenotype	Field ID
LV	319.4	0.26	LVM	Systolic blood pressure	4080-2.0
	307.7	-0.33	LVEDV	Pulse rate	4194-2.0
	226.5	0.22	Wall thickness AHA 9	Diastolic blood pressure	4079-2.0
	160.8	0.17	LVEDV	Number of days/week of vigorous physical activity	904-2.0
	69.8	0.11	LVEDV	Number of days/week of moderate physical activity	884-2.0
RV	307.7	-0.33	RVEDV	Pulse rate	4194-2.0
	180.0	0.18	RVEDV	Number of days/week of vigorous physical activity	904-2.0
	133.3	0.17	RVEF	Systolic blood pressure	4080-2.0
	73.6	-0.11	RVEDV	Overall health rating	2178-2.0
	70.0	0.11	RVEDV	Number of days/week of moderate physical activity	884-2.0
LA	307.7	-0.25	LAV max	Pulse rate	4194-2.0
	83.8	0.12	LASV	Number of days/week of vigorous physical activity	904-2.0
	68.1	0.11	LASV	Systolic blood pressure	4080-0.0
	33.9	0.08	LASV	Number of days/week of moderate physical activity	884-2.0
	29.4	-0.07	LASV	Overall health rating	2178-2.0
RA	213.4	-0.20	RAV min	Pulse rate	4194-2.0
	82.0	0.12	RAV min	Number of days/week of vigorous physical activity	904-2.0
	45.4	0.10	RAEF	Systolic blood pressure	4080-2.0
	41.7	-0.12	RAV min	Types of physical activity in last 4 weeks	6164-0.2
	36.7	-0.08	RAV max	Overall health rating	2178-0.0
AAo	260.1	0.22	AAo min area	Diastolic blood pressure	4079-0.0
	128.5	-0.18	AAo distensibility	Systolic blood pressure	4080-2.0
	46.2	-0.11	AAo distensibility	Pulse rate	102-2.0
	45.1	0.12	AAo min area	Birth weight	20022-0.0
	37.5	0.08	AAo max area	Whole body fat mass	23100-0.0
DAo	167.6	0.19	DAo min area	Diastolic blood pressure	4079-2.0
	130.0	-0.18	DAo distensibility	Systolic blood pressure	4080-2.0
	82.0	-0.13	DAo max area	Pulse rate	102-0.1
	64.3	0.11	DAo max area	Whole body fat mass	23100-0.0
	60.5	0.10	DAo max area	Hip circumference	49-0.0

Supplementary Table 11. Five most significant PheWAS associations for each anatomical structure. Note that if a non-imaging phenotype has multiple associations with imaging phenotypes of the same anatomical structure, only the top association is shown. For example, systolic blood pressure is significantly associated with several LV imaging phenotypes, including LVM, LVEDV, LVSV etc, but only the top association (lowest p-value) is shown, which is (LVM, Systolic blood pressure). Columns 2 and 3 denote the negative logarithm of correlation p-value (two-sided t-test) and Pearson's correlation coefficient r. Field ID denotes the UK Biobank code for the non-imaging phenotype. n = 26,893 subjects were included in the analysis.

Structure	$-\log_{10}(p)$	r	Imaging phenotype	Non-imaging phenotype	Field ID
LV	13.4	0.05	Wall thickness Global	Risk taking	2040-2.0
	11.1	-0.04	LVEDV	Happiness	4526-2.0
	8.7	-0.04	LVEDV	Neuroticism score	20127-0.0
	8.3	-0.04	LVSV	Seen doctor (GP) for nerves, anxiety, tension or depression	2090-2.0
	7.5	-0.03	LVEDV	Ever depressed for a whole week	4598-2.0
RV	16.5	-0.06	RVEDV	Neuroticism score	20127-0.0
	13.6	0.05	RVESV	Risk taking	2040-2.0
	12.1	-0.05	RVEDV	Frequency of depressed mood in last 2 weeks	2050-0.0
	10.7	-0.04	RVEDV	Happiness	4526-2.0
	9.0	-0.04	RVEDV	Seen doctor (GP) for nerves, anxiety, tension or depression	2090-0.0
LA	10.5	-0.04	LAV max	Happiness	4526-2.0
	10.2	-0.04	LASV	Frequency of depressed mood in last 2 weeks	2050-2.0
	6.8	-0.04	LASV	Neuroticism score	20127-0.0
	6.4	-0.03	LASV	Seen a psychiatrist for nerves, anxiety, tension or depression	2100-2.0
	6.4	-0.03	LAEF	Risk taking	2040-2.0
RA	14.5	-0.05	RAEF	Risk taking	2040-2.0
	10.9	-0.05	RAV max	Neuroticism score	20127-0.0
	8.3	-0.04	RAV max	Frequency of depressed mood in last 2 weeks	2050-0.0
	6.7	-0.03	RAV max	Seen doctor (GP) for nerves, anxiety, tension or depression	2090-2.0
	5.1	-0.03	RASV	Seen a psychiatrist for nerves, anxiety, tension or depression	2100-0.0
AAo	4.6	0.03	AAo max area	Risk taking	2040-0.0
	2.9	0.04	AAo max area	Substances taken for depression	20546-0.1
	1.9	0.05	AAo max area	Substances taken for anxiety	20549-0.1
	1.6	0.03	AAo distensibility	Frequency of depressed mood in last 2 weeks	2050-1.0
	1.4	0.03	AAo distensibility	Ever depressed for a whole week	4598-1.0
DAo	5.4	-0.03	DAo max area	Happiness	4526-2.0
	5.3	0.03	DAo max area	Risk taking	2040-0.0
	1.9	-0.02	DAo min area	Ever depressed for a whole week	4598-2.0
	1.9	0.03	DAo max area	Substances taken for depression	20546-0.1
	1.9	-0.02	DAo max area	Frequency of depressed mood in last 2 weeks	2050-0.0

Supplementary Table 12. Five most significant PheWAS associations in the mental health category for each anatomical structure. Columns 2 and 3 denote the negative logarithm of correlation p-value (two-sided t-test) and Pearson's correlation coefficient r. n = 26,893 subjects were included in the analysis.

Structure	$-\log_{10}(p)$	r	Imaging phenotype	Non-imaging phenotype	Field ID
LV	8.7	-0.04	E_{cc} AHA 15	Time to answer	4288-2.0
	7.9	0.04	LVM	Fluid intelligence score	20016-2.0
	5.3	-0.04	E_{ll} 3	Time elapsed	4256-2.1
	5.0	-0.04	E_{ll} 3	Interval between previous point and current one in alphanumeric path	6773-2.8
	4.8	-0.04	E_{ll} 3	Time last key touched	4255-2.1
RV	28.8	0.07	RVESV	Fluid intelligence score	20016-2.0
	7.1	-0.03	RVEDV	Duration to first press of snap-button in each round	404-2.10
	6.5	-0.03	RVEDV	Mean time to correctly identify matches	20023-2.0
	6.4	0.04	RVESV	Number of puzzles correctly solved	6373-2.0
	5.5	0.03	RVEDV	FI3 : word interpolation	4957-2.0
LA	7.9	0.05	LAV min	Interval between previous point and current one in alphanumeric path	6773-2.11
	5.0	0.04	LAV min	Interval between previous point and current one in numeric path	6772-2.21
	4.7	0.04	LAV min	Duration to complete alphanumeric path	6350-2.0
	4.4	0.03	LAV min	Duration to first press of snap-button in each round	404-2.7
	4.3	0.03	LAV min	Time elapsed	4256-2.2
RA	18.8	0.06	RAV max	Fluid intelligence score	20016-2.0
	6.1	0.04	RAV min	Maximum digits remembered correctly	4282-2.0
	5.7	0.04	RAV min	Number of rounds of numeric memory test performed	4283-2.0
	4.5	0.04	RAV max	Value entered	6312-2.6
	4.2	0.04	RAV max	Number of puzzles correctly solved	6373-2.0
AAo	2.8	0.03	AAo max area	Total errors traversing alphanumeric path	6351-2.0
	2.5	0.03	AAo max area	Interval between previous point and current one in alphanumeric path	6773-2.0
	2.4	0.02	AAo max area	Time to complete round	400-2.3
	2.3	-0.03	AAo distensibility	Duration to first press of snap-button in each round	404-0.3
	2.2	0.02	AAo max area	Time last key touched	4255-2.0
DAo	5.2	0.04	DAo min area	Total errors traversing alphanumeric path	6351-2.0
	5.0	-0.04	DAo min area	Number of puzzles correctly solved	6373-2.0
	3.3	-0.03	DAo min area	Number of symbol digit matches made correctly	23324-2.0
	3.3	0.03	DAo max area	Interval between previous point and current one in alphanumeric path	6773-2.0
	3.1	0.02	DAo min area	Mean time to correctly identify matches	20023-0.0

Supplementary Table 13. Five most significant PheWAS associations in the cognitive function category for each anatomical structure. Columns 2 and 3 denote the negative logarithm of correlation p-value (two-sided t-test) and Pearson's correlation coefficient r. n = 26,893 subjects were included in the analysis.

	LVM (g)	**LVEDV (mL)**	**LVEF (%)**	**RVEDV (mL)**	**RVEF (%)**
Birth weight, per 0.6 kg	$0.5_{[0.3,0.7]}$ (p=1.4×10^{-5})	$1.0_{[0.6,1.5]}$ (p=7.5×10^{-7})	$0.1_{[-0.0,0.2]}$ (p=0.090)	$1.8_{[1.3,2.2]}$ (p=7.4×10^{-15})	$-0.1_{[-0.2,-0.0]}$ (p=0.013)
	LAV max (mL)	**LAEF (%)**	**RAV max (mL)**	**RAEF (%)**	
Birth weight, per 0.6 kg	$-0.7_{[-1.0,-0.3]}$ (p=4.3×10^{-4})	$0.4_{[0.2,0.5]}$ (p=2.5×10^{-6})	$1.7_{[1.2,2.1]}$ (p=2.2×10^{-14})	$0.2_{[0.0,0.4]}$ (p=0.011)	
	AAo max area (mm^2)	**AAo distensibility**	**DAo max area (mm^2)**	**DAo distensibility**	
Birth weight, per 0.6 kg	$20.2_{[17.3,23.2]}$ (p=10^{-40})	$-0.04_{[-0.1,-0.0]}$ (p=8.8×10^{-4})	$7.1_{[5.8,8.5]}$ (p=3.2×10^{-26})	$-0.1_{[-0.1,-0.0]}$ (p=5.5×10^{-4})	

Supplementary Table 14. Associations of cardiac and aortic imaging phenotypes with birth weight. Sex, age, sex * age, weight, height, SBP, DBP, current smoking status, alcohol intake, vigorous PA frequency, high cholesterol and diabetes were adjusted in regression. n = 12,169 subjects were analysed with available information for all independent variables. The values are depicted as regression coefficient β [95% confidence interval] (two-sided t-test p-value).

	LVM (g)	LVEDV (mL)	LVEF (%)	RVEDV (mL)	RVEF (%)
Risk taking	$1.0_{[0.6,1.4]}$ (p=4.4×10^{-6})	$0.02_{[-0.8,0.8]}$ (p=0.962)	$-0.3_{[-0.5,-0.1]}$ (p=0.004)	$0.2_{[-0.7,1.0]}$ (p=0.724)	$-0.5_{[-0.7,-0.3]}$ (p=1.6×10^{-7})
Neuroticism score, per 3.2	$-0.03_{[-0.2,0.2]}$ (p=0.744)	$-0.6_{[-0.9,-0.2]}$ (p=0.002)	$0.1_{[-0.0,0.2]}$ (p=0.129)	$-1.0_{[-1.3,-0.6]}$ (p=9.8×10^{-7})	$0.1_{[0.0,0.2]}$ (p=0.019)
	LAV max (mL)	**LAEF (%)**	**RAV max (mL)**	**RAEF (%)**	
Risk taking	$-0.3_{[-1.0,0.5]}$ (p=0.489)	$-0.5_{[-0.8,-0.2]}$ (p=0.001)	$0.8_{[-0.0,1.6]}$ (p=0.063)	$-0.8_{[-1.1,-0.5]}$ (p=5.3×10^{-7})	
Neuroticism score, per 3.2	$-0.4_{[-0.7,-0.1]}$ (p=0.023)	$-0.04_{[-0.2,0.1]}$ (p=0.585)	$-0.7_{[-1.0,-0.3]}$ (p=3.7×10^{-4})	$0.05_{[-0.1,0.2]}$ (p=0.477)	
	AAo max area (mm^2)	**AAo distensibility**	**DAo max area (mm^2)**	**DAo distensibility**	
Risk taking	$5.4_{[-0.3,11.1]}$ (p=0.064)	$-0.01_{[-0.1,0.0]}$ (p=0.553)	$1.5_{[-1.0,4.1]}$ (p=0.242)	$0.02_{[-0.0,0.1]}$ (p=0.462)	
Neuroticism score, per 3.2	$1.1_{[-1.4,3.7]}$ (p=0.380)	$-0.01_{[-0.0,0.0]}$ (p=0.391)	$-0.3_{[-1.5,0.8]}$ (p=0.572)	$-0.01_{[-0.0,0.0]}$ (p=0.658)	

Supplementary Table 15. Associations of cardiac and aortic imaging phenotypes with mental health measures. Sex, age, sex * age, weight, height, SBP, DBP, current smoking status, alcohol intake, vigorous PA frequency, high cholesterol and diabetes were adjusted in regression. n = 16,568 subjects were analysed with available information for all independent variables. The values are depicted as regression coefficient β [95% confidence interval] (two-sided t-test p-value). Risk taking is a binary variable, with 0 denoting no and 1 denoting yes. Neuroticism score ranges from 0 to 12.

	LVM (g)	LVEDV (mL)	LVEF (%)	RVEDV (mL)	RVEF (%)
Fluid intelligence, per 2.1	$0.8_{[0.6,0.9]}$ (p=1.8×10^{-18})	$1.1_{[0.7,1.4]}$ (p=3.3×10^{-10})	$-0.1_{[-0.2,-0.0]}$ (p=0.033)	$2.0_{[1.6,2.3]}$ (p=2×10^{-26})	$-0.3_{[-0.3,-0.2]}$ (p=3.9×10^{-10})
	LAV max (mL)	**LAEF (%)**	**RAV max (mL)**	**RAEF (%)**	
Fluid intelligence, per 2.1	$0.1_{[-0.2,0.4]}$ (p=0.553)	$-0.01_{[-0.1,0.1]}$ (p=0.879)	$1.6_{[1.3,2.0]}$ (p=1.9×10^{-20})	$-0.2_{[-0.3,-0.0]}$ (p=0.013)	
	AAo max area (mm^2)	**AAo distensibility**	**DAo max area (mm^2)**	**DAo distensibility**	
Fluid intelligence, per 2.1	$3.1_{[0.7,5.4]}$ (p=0.012)	$-0.01_{[-0.0,0.0]}$ (p=0.194)	$0.7_{[-0.4,1.8]}$ (p=0.208)	$0.00_{[-0.0,0.0]}$ (p=0.926)	

Supplementary Table 16. Associations of cardiac and aortic imaging phenotypes with fluid intelligence score. Sex, age, sex * age, weight, height, SBP, DBP, current smoking status, alcohol intake, vigorous PA frequency, high cholesterol and diabetes are adjusted in regression. n = 18,369 subjects were analysed with available information for all independent variables. The values are depicted as regression coefficient β [95% confidence interval] (two-sided t-test p-value). Fluid intelligence score ranges from 0 to 13.

Risk factor	Data source	Cohorts
SBP	Evangelou et al, 2018[73]	UK Biobank (n = 458,577) + ICBP (n = 299,024) + MVP (n = 220,520) + EGCUT (n = 28,742)
Diabetes	Morris et al, 2012[74]	DIAGRAM (n = 12,171 cases, n = 56,862 controls)
Birth weight	Warrington et al, 2019[75]	EGG (n = 80,745) + UK Biobank (n = 217,397)
Risk tolerance	Linner et al, 2019[76]	UK Biobank (n = 431,126) + 10 replication cohorts (n = 35,445)
Fluid intelligence	Davies et al, 2011[77]	CAGES (n = 3,511)

Supplementary Table 17. Data sources for the genetic associations of risk factors of interest. ICBP: International Consortium of Blood Pressure Genome Wide Association Studies; MVP: Million Veteran Program; EGCUT, Estonian Genome Center, University of Tartu; DIAGRAM: DIAbetes Genetics Replication and Meta-analysis; EGG: Early Growth Genetics; CAGES: Cognitive Ageing Genetics in England and Scotland.

	Risk factor	Observational analysis	Mendelian randomisation		
			IVW	WM	MR-Egger
LVM (g)	SBP, per 18.0 mmHg	$4.8_{[4.6,5.1]}$ ($p=10^{-324}$)	$4.8_{[1.4,8.2]}$ ($p=0.006$)	$4.6_{[0.1,9.0]}$ ($p=0.044$)	$11.7_{[-1.5,24.9]}$ ($p=0.085$)
	Diabetes	$-1.0_{[-1.8,-0.1]}$ ($p=0.025$)	$-0.3_{[-1.2,0.6]}$ ($p=0.499$)	$-0.3_{[-1.3,0.7]}$ ($p=0.539$)	$-0.02_{[-5.4,5.3]}$ ($p=0.995$)
	Birth weight, per 0.6 kg	$0.5_{[0.3,0.7]}$ ($p=1.4\times10^{-5}$)	$1.2_{[0.5,1.9]}$ ($p=0.001$)	$1.0_{[0.0,2.1]}$ ($p=0.049$)	$1.8_{[-0.2,3.7]}$ ($p=0.078$)
	Risk taking	$1.0_{[0.6,1.4]}$ ($p=4.4\times10^{-6}$)	$2.4_{[-1.5,6.3]}$ ($p=0.233$)	$3.8_{[-2.0,9.5]}$ ($p=0.196$)	$11.1_{[-5.3,27.5]}$ ($p=0.196$)
	Fluid intelligence, per 2.1	$0.8_{[0.6,0.9]}$ ($p=1.8\times10^{-18}$)	$0.1_{[-1.1,1.4]}$ ($p=0.825$)	$0.2_{[-1.4,1.8]}$ ($p=0.820$)	$-1.6_{[-7.3,4.2]}$ ($p=0.601$)
LVEDV (mL)	SBP, per 18.0 mmHg	$5.8_{[5.3,6.3]}$ ($p=2.4\times10^{-130}$)	$0.8_{[-4.8,6.5]}$ ($p=0.771$)	$-3.5_{[-11.0,3.9]}$ ($p=0.355$)	$-5.5_{[-27.1,16.1]}$ ($p=0.617$)
	Diabetes	$-8.7_{[-10.3,-7.0]}$ ($p=1.4\times10^{-24}$)	$-0.7_{[-2.1,0.8]}$ ($p=0.382$)	$-0.9_{[-2.5,0.8]}$ ($p=0.311$)	$-2.4_{[-11.3,6.5]}$ ($p=0.615$)
	Birth weight, per 0.6 kg	$1.0_{[0.6,1.5]}$ ($p=7.5\times10^{-7}$)	$2.4_{[1.1,3.6]}$ ($p=1.5\times10^{-4}$)	$1.9_{[0.2,3.6]}$ ($p=0.031$)	$3.0_{[-0.3,6.4]}$ ($p=0.079$)
	Risk taking	$0.02_{[-0.8,0.8]}$ ($p=0.962$)	$1.2_{[-5.5,7.9]}$ ($p=0.725$)	$3.8_{[-6.1,13.8]}$ ($p=0.452$)	$14.3_{[-13.9,42.6]}$ ($p=0.328$)
	Fluid intelligence, per 2.1	$1.1_{[0.7,1.4]}$ ($p=3.3\times10^{-10}$)	$0.3_{[-1.8,2.4]}$ ($p=0.769$)	$0.3_{[-2.5,3.2]}$ ($p=0.816$)	$-1.3_{[-11.2,8.6]}$ ($p=0.806$)
LVEF (%)	SBP, per 18.0 mmHg	$0.9_{[0.8,1.0]}$ ($p=4.9\times10^{-49}$)	$0.2_{[-1.1,1.5]}$ ($p=0.757$)	$0.4_{[-1.3,2.1]}$ ($p=0.665$)	$2.6_{[-2.4,7.7]}$ ($p=0.309$)
	Diabetes	$-1.0_{[-1.4,-0.5]}$ ($p=5.1\times10^{-6}$)	$-0.2_{[-0.5,0.1]}$ ($p=0.165$)	$-0.3_{[-0.6,0.1]}$ ($p=0.116$)	$-0.8_{[-2.3,0.7]}$ ($p=0.342$)
	Birth weight, per 0.6 kg	$0.1_{[-0.0,0.2]}$ ($p=0.090$)	$0.2_{[-0.0,0.5]}$ ($p=0.080$)	$0.2_{[-0.2,0.6]}$ ($p=0.258$)	$-0.1_{[-0.8,0.7]}$ ($p=0.863$)
	Risk taking	$-0.3_{[-0.5,-0.1]}$ ($p=0.004$)	$0.5_{[-1.3,2.2]}$ ($p=0.618$)	$0.4_{[-2.1,2.8]}$ ($p=0.773$)	$0.9_{[-6.7,8.4]}$ ($p=0.827$)
	Fluid intelligence, per 2.1	$-0.1_{[-0.2,-0.0]}$ ($p=0.033$)	$0.2_{[-0.3,0.7]}$ ($p=0.364$)	$0.2_{[-0.5,0.8]}$ ($p=0.575$)	$1.3_{[-1.0,3.6]}$ ($p=0.288$)
RVEDV (mL)	SBP, per 18.0 mmHg	$3.0_{[2.5,3.5]}$ ($p=4.8\times10^{-32}$)	$0.04_{[-5.8,5.9]}$ ($p=0.988$)	$0.4_{[-7.5,8.4]}$ ($p=0.916$)	$9.0_{[-13.6,31.5]}$ ($p=0.439$)
	Diabetes	$-11.1_{[-12.9,-9.3]}$ ($p=3.4\times10^{-34}$)	$-1.6_{[-3.0,-0.3]}$ ($p=0.016$)	$-1.8_{[-3.5,-0.1]}$ ($p=0.036$)	$2.3_{[-4.9,9.5]}$ ($p=0.549$)
	Birth weight, per 0.6 kg	$1.8_{[1.3,2.2]}$ ($p=7.4\times10^{-15}$)	$3.2_{[1.8,4.5]}$ ($p=3.2\times10^{-6}$)	$2.8_{[1.0,4.6]}$ ($p=0.002$)	$4.3_{[0.6,7.9]}$ ($p=0.023$)
	Risk taking	$0.2_{[-0.7,1.0]}$ ($p=0.724$)	$3.1_{[-4.3,10.6]}$ ($p=0.407$)	$-0.5_{[-10.8,9.8]}$ ($p=0.919$)	$15.2_{[-16.2,46.5]}$ ($p=0.350$)
	Fluid intelligence, per 2.1	$2.0_{[1.6,2.3]}$ ($p=2\times10^{-26}$)	$0.1_{[-2.0,2.3]}$ ($p=0.894$)	$0.4_{[-2.7,3.5]}$ ($p=0.811$)	$-2.3_{[-12.9,8.2]}$ ($p=0.675$)
RVEF (%)	SBP, per 18.0 mmHg	$1.6_{[1.5,1.7]}$ ($p=1.4\times10^{-161}$)	$0.9_{[-0.5,2.2]}$ ($p=0.222$)	$-0.3_{[-2.0,1.4]}$ ($p=0.742$)	$0.4_{[-4.8,5.7]}$ ($p=0.877$)
	Diabetes	$-0.7_{[-1.1,-0.3]}$ ($p=5\times10^{-4}$)	$-0.1_{[-0.5,0.2]}$ ($p=0.543$)	$0.04_{[-0.3,0.4]}$ ($p=0.850$)	$-0.5_{[-2.7,1.6]}$ ($p=0.629$)
	Birth weight, per 0.6 kg	$-0.1_{[-0.2,-0.0]}$ ($p=0.013$)	$-0.1_{[-0.4,0.2]}$ ($p=0.458$)	$-0.1_{[-0.4,0.3]}$ ($p=0.790$)	$-0.7_{[-1.5,0.1]}$ ($p=0.070$)
	Risk taking	$-0.5_{[-0.7,-0.3]}$ ($p=1.6\times10^{-7}$)	$-0.1_{[-1.6,1.5]}$ ($p=0.946$)	$0.2_{[-2.1,2.5]}$ ($p=0.883$)	$0.1_{[-6.5,6.6]}$ ($p=0.979$)
	Fluid intelligence, per 2.1	$-0.3_{[-0.3,-0.2]}$ ($p=3.9\times10^{-10}$)	$0.1_{[-0.3,0.6]}$ ($p=0.581$)	$0.2_{[-0.5,0.9]}$ ($p=0.611$)	$2.3_{[0.0,4.6]}$ ($p=0.063$)
AAo max area (mm^2)	SBP, per 18.0 mmHg	$-13.5_{[-16.8,-10.2]}$ ($p=1.2\times10^{-15}$)	$32.3_{[-5.4,69.9]}$ ($p=0.093$)	$49.3_{[-4.4,103.0]}$ ($p=0.072$)	$60.3_{[-83.8,204.3]}$ ($p=0.415$)
	Diabetes	$-19.7_{[-31.5,-7.9]}$ ($p=0.001$)	$-12.0_{[-20.0,-4.0]}$ ($p=0.003$)	$-10.2_{[-20.5,0.1]}$ ($p=0.051$)	$-19.1_{[-64.0,25.8]}$ ($p=0.429$)
	Birth weight, per 0.6 kg	$20.2_{[17.3,23.2]}$ ($p=10^{-40}$)	$25.1_{[16.0,34.2]}$ ($p=6.2\times10^{-8}$)	$19.5_{[7.6,31.5]}$ ($p=0.001$)	$14.9_{[-10.2,39.9]}$ ($p=0.246$)
	Risk taking	$5.4_{[-0.3,11.1]}$ ($p=0.064$)	$15.2_{[-39.1,69.5]}$ ($p=0.582$)	$24.9_{[-48.4,98.2]}$ ($p=0.505$)	$152.2_{[-71.9,376.4]}$ ($p=0.194$)
	Fluid intelligence, per 2.1	$3.1_{[0.7,5.4]}$ ($p=0.012$)	$3.0_{[-13.9,20.0]}$ ($p=0.724$)	$6.5_{[-14.1,27.1]}$ ($p=0.538$)	$-17.8_{[-99.7,64.1]}$ ($p=0.676$)
AAo distensibility	SBP, per 18.0 mmHg	$-0.2_{[-0.2,-0.2]}$ ($p=1.1\times10^{-41}$)	$-0.3_{[-0.6,-0.0]}$ ($p=0.042$)	$-0.4_{[-0.8,-0.0]}$ ($p=0.048$)	$-1.0_{[-2.1,0.0]}$ ($p=0.062$)
	Diabetes	$0.00_{[-0.1,0.1]}$ ($p=0.991$)	$-0.1_{[-0.2,-0.0]}$ ($p=0.001$)	$-0.1_{[-0.2,-0.0]}$ ($p=0.014$)	$-0.2_{[-0.5,0.1]}$ ($p=0.297$)
	Birth weight, per 0.6 kg	$-0.04_{[-0.1,-0.0]}$ ($p=8.8\times10^{-4}$)	$-0.03_{[-0.1,0.0]}$ ($p=0.269$)	$0.01_{[-0.1,0.1]}$ ($p=0.898$)	$0.1_{[-0.0,0.3]}$ ($p=0.058$)
	Risk taking	$-0.01_{[-0.1,0.0]}$ ($p=0.553$)	$0.1_{[-0.3,0.5]}$ ($p=0.591$)	$-0.2_{[-0.7,0.3]}$ ($p=0.439$)	$-0.00_{[-1.5,1.5]}$ ($p=0.995$)
	Fluid intelligence, per 2.1	$-0.01_{[-0.0,0.0]}$ ($p=0.194$)	$-0.1_{[-0.2,0.1]}$ ($p=0.449$)	$-0.03_{[-0.2,0.1]}$ ($p=0.756$)	$0.2_{[-0.4,0.9]}$ ($p=0.490$)

Supplementary Table 18. Effects of risk factors on cardiac and aortic imaging phenotypes by Mendelian randomisation analysis, compared to observational analysis. For Mendelian randomisation, three methods were used, including inverse-variance weighting (IVW), weighted median (WM) and MR-Egger. Sex, age, height and genetic principal components were adjusted. n = 22,229 subjects were analysed with available genetic information. Observational analysis results come from previously reported tables in this paper. The values are depicted as regression coefficient β [95% confidence interval] (two-sided t-test p-value). The Bonferroni threshold for multiple comparison (5 risk factors and 7 imaging phenotypes) is $p_{Bonf} = 1.4 \times 10^{-3}$ for $\alpha = 0.05$.