

Supplemental Material

Table S1. Frequencies of Clinical Characteristics of Atherosclerosis Risk in the Community (ARIC) Visit 5 Participants.

Clinical Variable	N (%)
Age, y	6059 (100%)
Male sex	6059 (100%)
Black	6059 (100%)
Hypertension	6059 (100%)
Ever smoker	6059 (100%)
Coronary Artery Disease	6059 (100%)
History of Atrial Fibrillation	5943 (98%)
Heart Failure	6059 (100%)
Insulin Therapy	6059 (100%)
HbA1c (%)	6042 (99%)
Lipid-lowering medications	6026 (99%)
BMI (Kg/m2)	6025 (99%)
SBP (mmHg)	6038 (99%)
Heart rate (bpm)	5928 (97%)
eGFR, mL/min per 1.73 m2	6042 (99%)
LDL cholesterol, mg/dL	6001 (99%)
hs-CRP, mg/L	6040 (99%)
NT-pro-BNP (ng/l)	5898 (97%)
hs-troponin (ng/l)	5838 (96%)
LVEDDi, cm/m2	5942 (98%)
IVS, cm	6013 (99%)
LVMi, g/m2	6001 (99%)
LVH	6001 (99%)
LVEDVi, ml/m2	5825 (96%)
LVESVi, ml/m2	5825 (96%)
LVEF, %	5861 (96%)
GLS, %	5812 (96%)
RV FAC, %	5500 (90%)
LAVi, ml/m2	5986 (98%)
E-A ratio	5770 (95%)
E/e' average	6015 (99%)
PASP, mmHg	3535 (58.3%)

BMI, body mass index; eGFR, estimated glomerular filtration rate by Chronic Kidney Disease Epidemiology Collaboration equation; HbA1c, glycated hemoglobin; HDL, high-density lipoprotein; hs-CRP, high sensitivity-C-reactive protein; LDL, low-density lipoprotein; NT-pro-BNP, N-terminal pro-B-type natriuretic peptide; SBP, systolic blood pressure; GLS, global longitudinal strain; IVS, interventricular septum; LAVi, left atrial volume index; LVEDDi, left ventricular end-diastolic diameter index; LVEDVi, left ventricular end-diastolic volume index; LVESVi, left ventricular end-systolic volume index; LVEF, left ventricular ejection fraction; LVH, left ventricular hypertrophy; LVMi, LV mass index; RV FAC, right ventricular fractional area change.

Table S2. Adjusted association of Echocardiographic Characteristics at ARIC visit 5 and subsequent HF according to glycemic status.

	No DM (122/2208) 1.05 100 py				Pre DM (113/1818) 1.18 100 py				DM (227/2033) 2.25 100 py			
	HR	95% CI	p	Z	HR	95% CI	p	Z	HR	95% CI	p	Z
LV Structure												
LVEDDi, per 0.1 cm/m ² increase	1.16	1.09-1.20	< 0.001	5.5	1.16	1.11-1.24	< 0.001	5.4	1.17	1.09-1.25	< 0.001	4.3
IVS, per 0.1 cm increase	1.04	0.97-1.13	0.26	1.1	1.15	1.05-1.26	0.003	2.9	1.21	1.09-1.33	0.001	3.4
LVMi, per 10 g/m ²	1.14	1.10-1.21	< 0.001	5.7	1.33	1.25-1.43	< 0.001	8.3	1.27	1.18-1.35	< 0.001	7.1
LVH	2.15	1.55-2.96	< 0.001	4.6	4.02	2.57-6.28	< 0.001	6.2	3.0	1.92-4.67	< 0.001	4.8
EDVi, per 5 ml/m ² increase	1.19	1.12-1.24	< 0.001	6.32	1.19	1.11-1.26	< 0.001	4.7	1.20	1.11-1.30	< 0.001	4.8
ESVi, per 5 ml/m ² increase	1.22	1.14-1.31	< 0.001	5.7	1.25	1.13-1.37	< 0.001	4.4	1.31	1.22-1.45	< 0.001	6.2
Systolic Function												
LVEF, per 5 % increase	0.83	0.77-0.91	< 0.001	4.2	0.86	0.77-0.96	0.009	2.5	0.80	0.71-0.91	< 0.001	3.5
GLS, per 1 % increase	1.17	1.11-1.22	< 0.001	5.7	1.10	1.03-1.18	0.006	2.8	1.13	1.05-1.20	0.003	3.0
RV FAC, per 5 % increase	0.90	0.82-1.0	0.04	2.0	1.01	0.89-1.15	0.828	0.2	1.05	0.92-1.20	0.474	0.7
Diastolic Function												
LAVi, per 5 ml/m ² increase	1.24	1.18-1.3	< 0.001	8.7	1.13	1.09-1.18	< 0.001	5.8	1.11	1.05-1.15	< 0.001	3.9
E–A ratio, per 0.1 cm/s increase	1.09	1.05-1.12	< 0.001	4.0	1.09	1.04-1.15	< 0.001	3.8	1.16	1.12-1.21	< 0.001	7.1
E/e' average, per 1U increase	1.05	1.03-1.07	< 0.001	5.0	1.10	1.07-1.13	< 0.001	6.1	1.08	1.04-1.10	< 0.001	4.3

Adjustment: gender, race/center, log-total cholesterol, log-LDL, statins medication, history of hypertension, systolic blood pressure, heart rate, QRS interval, eGFR, BMI, smoking status, prevalent HF, heart valve disease, history of ICD/PM., stratified by age and history of coronary artery disease. GLS, global longitudinal strain; IVS, interventricular septum; LAVi, left atrial volume index; LVEDDi, left ventricular end-diastolic diameter index; LVEDVi, left ventricular end-diastolic volume index; LVESVi, left ventricular end-systolic volume index; LVEF, left ventricular ejection fraction; LVH, left ventricular hypertrophy; LVMi, LV mass index; RV FAC, right ventricular fractional area change.

Table S3. Adjusted association of Echocardiographic Characteristics and death or HF according to glycemic status in subjects free of prevalent heart disease (n = 4414).

	No DM (201/1730) 2.18 100 py				Pre DM (162/1354) 2.22 100 py				DM (216/1330) 3.09 100 py			
	HR	95% CI	p	Z	HR	95% CI	p	Z	HR	95% CI	p	Z
LV Structure												
LVEDDi, per 0.1 cm/m ² increase	1.08	1.1-1.16	0.04	2.2	1.15	1.12-1.22	<0.001	4.4	1.10	1.04-1.17	0.003	3.2
IVS, per 0.1 cm increase	1.05	0.95-1.17	0.42	0.8	1.07	0.96-1.20	0.29	1.0	1.16	1.06-1.27	0.001	3.3
LVMi, per 10 g/m ²	1.15	1.05-1.26	0.003	2.9	1.21	1.12-1.31	<0.001	4.8	1.28	1.19-1.36	<0.001	6.5
LVH	2.25	1.40-3.61	0.001	3.3	1.96	1.22-3.15	0.006	2.7	1.99	1.3-3.03	0.001	3.1
EDVi, per 5 ml/m ² increase	1.06	0.97-1.15	0.28	1.1	1.12	1.03-1.20	0.013	2.6	1.16	1.08-1.25	<0.001	4.0
ESVi, per 5 ml/m ² increase	1.19	1.01-1.4	0.04	2.0	1.22	1.06-1.4	0.004	2.8	1.33	1.19-1.48	<0.001	5.0
Systolic Function												
LVEF, per 5 % increase	0.88	0.77-0.99	0.036	2.1	0.90	0.78-1.04	0.13	1.4	0.77	0.68-0.87	<0.001	4.1
GLS, per 1 % increase	1.07	0.97-1.10	0.080	1.5	1.07	1.0-1.15	0.047	2.0	1.07	1.1-1.12	0.057	1.7
RV FAC, per 5 % increase	1.03	0.93-1.15	0.53	0.6	0.98	0.88-1.1	0.77	0.2	0.98	0.88-1.09	0.661	0.4
Diastolic Function												
LAVi, per 5 ml/m ² increase	1.09	1.03-1.14	0.010	2.7	1.10	1.0-1.2	0.046	2.0	1.22	1.13-1.31	<0.001	5.0
E–A ratio, per 0.1 cm/s increase	1.10	1.05-1.15	<0.001	3.9	1.08	1.01-1.16	0.026	2.2	0.98	0.92-1.05	0.64	0.4
E/e' average, per 1U increase	1.05	1.01-1.09	0.006	2.7	1.11	1.06-1.16	<0.001	4.4	1.02	0.97-1.06	0.48	0.7

Adjustment: gender, race/center, log-total cholesterol, log-LDL, statins medication, history of hypertension, systolic blood pressure, heart rate, QRS interval, eGFR, BMI, smoking status, prevalent HF, heart valve disease, history of ICD/PM., stratified by age and history of coronary artery disease. GLS, global longitudinal strain; IVS, interventricular septum; LAVi, left atrial volume index; LVEDDi, left ventricular end-diastolic diameter index; LVEDVi, left ventricular end-diastolic volume index; LVESVi, left ventricular end-systolic volume index; LVEF, left ventricular ejection fraction; LVH, left ventricular hypertrophy; LVMi, LV mass index; RV FAC, right ventricular fractional area change.

Table S4. Interaction of Echocardiographic Characteristics and the primary endpoint (death or HF) according to the glycemic status.

	p for interaction for glycemic status	
	Demographic adjusted	Multivariable adjusted
LV Structure		
LVEDDi, per 0.1 cm/m ² increase	0.79	0.74
IVS, per 0.1 cm increase	0.60	0.23
LVMi, per 10 g/m ²	0.51	0.41
LVH	0.37	0.36
EDVi, per 5 ml/m ² increase	0.09	0.19
ESDVi, per 5 ml/m ² increase	0.91	0.89
Systolic function		
LVEF, per 5 % increase	0.38	0.87
GLS, per 1 % increase	0.75	0.67
RV FAC, per 5 % increase	0.10	0.15
Diastolic function		
LAVi, per 5 ml/m ² increase	< 0.001	< 0.001
E–A ratio, per 0.1 cm/s increase	0.32	0.16
E/e' average, per 1U increase	0.44	0.21

Demographic adjustment: age, gender, race/center. Multivariable adjusted: gender, race/center, log-total cholesterol, log-LDL, statins medication, history of hypertension, systolic blood pressure, heart rate, QRS interval, eGFR, BMI, smoking status, prevalent HF, heart valve disease, history of ICD/PM., stratified by age and history of coronary artery disease. GLS, global longitudinal strain; IVS, interventricular septum; LAVi, left atrial volume index; LVEDDi, left ventricular end-diastolic diameter index; LVEDVi, left ventricular end-diastolic volume index; LVESVi, left ventricular end-systolic volume index; LVEF, left ventricular ejection fraction; LVH, left ventricular hypertrophy; LVMi, LV mass index; RV FAC, right ventricular fractional area change. GLS, global longitudinal strain; IVS, interventricular septum; LAVi, left atrial volume index; LVEDDi, left ventricular end-diastolic diameter index; LVEDVi, left ventricular end-diastolic volume index; LVESVi, left ventricular end-systolic volume index; LVEF, left ventricular ejection fraction; LVH, left ventricular hypertrophy; LVMi, LV mass index; RV FAC, right ventricular fractional area change.

Table S5. Interaction of Echocardiographic Characteristics and HF according to the glycemic status.

	p for interaction for glycemic status	
	Demographic adjusted	Multivariable adjusted
LV Structure		
LVEDDi, per 0.1 cm/m2 increase	0.49	0.99
IVS, per 0.1 cm increase	0.032	0.010
LVMi, per 10 g/m2	0.009	0.011
LVH	0.046	0.15
EDVi, per 5 ml/m2 increase	0.85	0.80
ESDVi, per 5 ml/m2 increase	0.21	0.13
Systolic function		
LVEF, per 5 % increase	0.53	0.26
GLS, per 1 % increase	0.62	0.87
RV FAC, per 5 % increase	0.19	0.14
Diastolic function		
LAVi, per 5 ml/m2 increase	< 0.001	0.001
E–A ratio, per 0.1 cm/s increase	0.13	0.01
E/e' average, per 1U increase	0.31	0.28

Demographic adjustment: age, gender, race/center. Multivariable adjusted: gender, race/center, log-total cholesterol, log-LDL, statins medication, history of hypertension, systolic blood pressure, heart rate, QRS interval, eGFR, BMI, smoking status, prevalent HF, heart valve disease, history of ICD/PM., stratified by age and history of coronary artery disease. GLS, global longitudinal strain; IVS, interventricular septum; LAVi, left atrial volume index; LVEDDi, left ventricular end-diastolic diameter index; LVEDVi, left ventricular end-diastolic volume index; LVESVi, left ventricular end-systolic volume index; LVEF, left ventricular ejection fraction; LVH, left ventricular hypertrophy; LVMi, LV mass index; RV FAC, right ventricular fractional area change.

Table S6. Interaction of Echocardiographic Characteristics and death or HF according to the glycemic status in subjects free of prevalent heart disease (n = 4414).

	p for interaction for glycemic status	
	Demographic adjusted	Multivariable adjusted
LV Structure		
LVEDDi, per 0.1 cm/m ² increase	0.64	0.78
IVS, per 0.1 cm increase	0.27	0.13
LVMi, per 10 g/m ²	0.07	0.13
LVH	0.46	0.87
EDVi, per 5 ml/m ² increase	0.020	0.024
ESDVi, per 5 ml/m ² increase	0.25	0.28
Systolic function		
LVEF, per 5 % increase	0.21	0.30
GLS, per 1 % increase	0.50	0.48
RV FAC, per 5 % increase	0.51	0.98
Diastolic function		
LAVi, per 5 ml/m ² increase	0.011	0.004
E–A ratio, per 0.1 cm/s increase	0.21	0.09
E/e' average, per 1U increase	0.44	0.09

Demographic adjustment: age, gender, race/center. Multivariable adjusted: gender, race/center, log-total cholesterol, log-LDL, statins medication, history of hypertension, systolic blood pressure, heart rate, QRS interval, eGFR, BMI, smoking status, prevalent HF, heart valve disease, history of ICD/PM., stratified by age and history of coronary artery disease. GLS, global longitudinal strain; IVS, interventricular septum; LAVi, left atrial volume index; LVEDDi, left ventricular end-diastolic diameter index; LVEDVi, left ventricular end-diastolic volume index; LVESVi, left ventricular end-systolic volume index; LVEF, left ventricular ejection fraction; LVH, left ventricular hypertrophy; LVMi, LV mass index; RV FAC, right ventricular fractional area change.

Table S7. Contribution of cardiac structure and function and comorbidities to the risk of death or HF in the DM population without prevalent heart disease.

	<i>HR (95% CI)</i>	<i>Attenuation of association (95% CI)</i>
DM (vs. No DM)	1.45 (1.22-1.71)	REF
+ LV structure	1.37 (1.15-1.62)	13% (3% to 33%)
+ Systolic function	1.35 (1.14-1.61)	10% (3% to 27%)
+ Diastolic function	1.38 (1.16-1.64)	4% (- 3% to 15%)
+ All cardiac structure and function	1.33 (1.11-1.59)	19% (6% to 47%)
+ Comorbidities	1.32 (1.11-1.63)	22% (-6% to 73%)

Attenuation of association is the proportion of the association between diabetes and the risk of death or HF that can be accounted for by listed parameters of cardiac structure and function or clinical characteristics, adjusting for demographics. Analyses are restricted to participants with available measurements of cardiac structure and function. Demographics: age, gender, race/center. LV structure parameters include: left ventricular hypertrophy, LV mass, interventricular septum. Systolic function parameters include: global longitudinal strain. Diastolic function parameters include: left atrial volume index, index and E/e'. Comorbidities include: demographics + log-total cholesterol, log-LDL, statins medication, history of hypertension, systolic blood pressure, heart rate, QRS interval, eGFR, BMI, smoking status.