

Supplementary table 1: Univariable linear regression for log(UACR) from the index cohort

Variable	Adjusted R²	P for R²
<i>Demographics</i>		
Type of visit	0.007	<0.001
Hospitalisation		
Outpatient Visit		
Age (years)	0.014	<0.001
Sex (% Male)	0	0.146
Race	-0.001	0.735
Weight (kg)	0	0.57
BMI (kg/m ²)	0	0.484
LVEF (%)	0.003	0.004
Systolic Blood Pressure (mmHg)	0.018	<0.001
Diastolic Blood Pressure (mmHg)	0.002	0.01
Heart Rate (beats/min)	0.009	<0.001
Duration of heart failure (years)	-0.002	0.419
NYHA class	0.025	<0.001
I		
II		
III		
IV		
<i>Medication use</i>		
ACE-inhibitors or ARB (%)	0.007	<0.001
Beta blockers (%)	0.002	0.021
Mineralocorticoid Receptor Antagonists (%)	0.009	<0.001
Digoxin (%)	0	0.488
Loop diuretic dose (furosemide or equivalent)	0.009	<0.001
<i>Medical History</i>		
Myocardial infarction (%)	0	0.847
Coronary artery bypass graft (%)	0	0.268

Valvular disease (%)	0	0.852
PCI (%)	0	0.667
Atrial fibrillation (%)	0.004	0.002
Stroke (%)	0.002	0.017
Peripheral Vascular Disease (%)	0.009	<0.001
Hypertension (%)	0.017	<0.001
Diabetes Mellitus (%)	0.031	<0.001
COPD (%)	0	0.587
Renal Disease (%)	0.024	<0.001
Treated thyroid disease (%)	-0.001	0.781
No		
Hypothyroidism		
Hyperthyroidism		
Current Malignancy (%)	0.001	0.044
<i>Heart failure aetiology</i>	0.014	<0.001
Cardiomyopathy		
Valvular Disease		
Hypertensive		
Other		
Unknown		
<i>Clinical Profile</i>		
Rales/crackles	0.014	<0.001
Pulmonary congestion > 1/3 up lung fields (%)	0.005	0.008
Peripheral oedema (%)	0.04	<0.001
Elevated JVP (%)	0.016	<0.001
Haepatomegaly (%)	0.006	<0.001
Third heart tone (%)	0	0.526
Orthopnoea (%)	0.008	<0.001
Dyspnoea VAS score	0.007	0.023
<i>Chest X-ray</i>		
Pulmonary oedema (%)	0.004	0.005

Upper lobe venous congestion (%)	0.01	<0.001
Cardiomegaly (defined as CTR > 0.5) (%)	0.012	<0.001
<i>Laboratory values</i>		
Haemoglobin (g/dL)**	0.013	<0.001
Log Haematocrit (%)	0.005	0.001
Serum Creatinine (µmol/L)	0.048	<0.001
eGFR (ml/min)**	0.031	<0.001
Log Urea (mmol/L)	0.021	<0.001
Log Fractional excretion of Urea	0.001	0.0845
Sodium (mmol/L)	0	0.353
Potassium (mmol/L)	0.002	0.015
Log NT pro-BNP (ng/L)	0.113	<0.001
Serum Albumin (mmol/L)	0.023	<0.001
ALAT (U/L)*	-0.001	0.68
Alkaline Phosphatase (µg/L)*	0.01	<0.001
Gamma-GT (U/L)*	0.006	0.009
Total bilirubin*	0.002	0.084
Transferrin (g/L)	-0.002	0.419
Ferritin (pmol/L)	0.001	0.273
TSH (mU/L)	-0.001	0.971
Triglycerides (mmol/L)*	0.003	0.045
Total Cholesterol (mmol/L)*	0.01	<0.001
HDL (mmol/L)*	0.012	<0.001
LDL (mmol/L)*	0.008	0.003
Log bio-ADM (pg/mL)	0.072	<0.001
Troponin T (ug/L)	-0.002	0.861
Glucose (mmol/L)	0.031	<0.001
Log Aldosterone (pg/mL)	0.007	0.001
Log Renin (UI/mL)	0.011	<0.001
Log GDF-15 (pg/mL)	0.127	<0.001

Log FGF-23 (RU/ml)	0.099	<0.001
Log CA-125	0.037	<0.001
Log Urinary KIM-1 (µg/mL)	0.031	<0.001
Log Urinary NGAL (µg/mL)	0.011	<0.001
Log Plasma NGAL (ng/mL)	0.026	<0.001
Log Urinary osteopontin (µg/mL)	0	0.838
Log Urinary uromodulin (µg/mL)	0.018	<0.001

* Omitted from multivariable model due to >1/3 missingness, **omitted from multivariable model due to collinearity with another variable.

Abbreviations: BMI: body mass index; LVEF: left ventricular ejection fraction; NYHA: New York Heart Association; ACE: angiotensin converter enzyme; ARB: angiotensin receptor blocker; PCI: percutaneous coronary intervention; COPD: chronic obstructive pulmonary disease; VAS: visual analogue scale; CTR: cor-to-thorax ratio; eGFR; estimated glomerular filtration rate; NT pro-BNP: N-terminal pro-B type natriuretic peptide; ALAT: alanine transferase; gamma-GT: gamma-glutamyltransferase; TSH: thyroid stimulating hormone; HDL: high density lipoprotein; LDL: low density lipoprotein; bio-ADM: biologically active adrenomedullin; GDF-15: Growth differentiation factor 15; FGF-23: Fibroblast growth factor 23; CA-125: cancer antigen 125; KIM-1: kidney injury marker-1; NGAL: Neutrophil gelatinase-associated lipocalin.

Supplementary table 2a:**NYHA I/II index**

Variable	Standardised Beta	95% CI	T-value	P-value
log NT pro-BNP	0.406	(0.27-0.54)	5.87	<0.001
History of diabetes	0.748	(0.47-1.03)	5.202	<0.001
log Renin	-0.291	(-0.42--0.16)	-4.356	<0.001
log Bio-ADM	0.331	(0.16-0.5)	3.872	<0.001
log Urinary NGAL	0.162	(0.04-0.29)	2.562	0.011
log Creatinine	0.129	(0-0.26)	1.964	0.05

N = 710

Adj R2 = 0,1779

NYHA III index

Variable	Standardised Beta	95% CI	T-value	P-value
log NT pro-BNP	0.489	(0.35-0.63)	6.707	<0.001
log Urinary KIM1	0.396	(0.27-0.53)	6.025	<0.001
log UREA	0.365	(0.21-0.52)	4.526	<0.001
Systolic Blood Pressure	0.272	(0.14-0.4)	4.122	<0.001
History of diabetes	0.508	(0.26-0.76)	3.991	<0.001
log Fractional Excretion of Urea	0.317	(0.15-0.48)	3.818	<0.001
Peripheral edema above knees	0.692	(0.25-1.14)	3.066	0.002
log Renin	-0.257	(-0.39--0.13)	-3.876	<0.001
log Urinary Uromodulin	-0.191	(-0.32--0.07)	-3.004	0.003
log Bio-ADM	0.182	(0.05-0.31)	2.795	0.005

N = 661

Adj R2 = 0,3009

NYHA IV index

Variable	Standardised Beta	95% CI	T-value	P-value
log Glucose	0.428	(0.19-0.67)	3.518	0.001
log NT pro-BNP	0.483	(0.21-0.76)	3.482	0.001
History of hypertension	0.713	(0.24-1.18)	3	0.003
log Urinary KIM-1	0.397	(0.13-0.66)	2.977	0.003
Jugular venous distention	0.628	(0.15-1.1)	2.609	0.01
log Creatinine	-0.372	(-0.66--0.08)	-2.55	0.012
History of renal disease	0.615	(0.03-1.2)	2.091	0.038
ACE-inhibitor use	-0.512	(-0.99--0.03)	-2.115	0.036

N = 153

Adj R2 = 0,269

Supplementary table 2b:**NYHA I/II Validation**

Variable	Standardised Beta	95% CI	T-value	P-value
log NT pro-BNP	0.633	(0.5-0.76)	9.701	<0.001
History of diabetes	0.514	(0.27-0.76)	4.182	<0.001
log bilirubin	0.214	(0.09-0.34)	3.365	0.001
History of hypertension	0.361	(0.14-0.58)	3.208	0.001
History of peripheral artery disease	0.367	(0.09-0.65)	2.557	0.011

N = 595

R² = 0.213**NYHA III validation**

Variable	Standardised Beta	95% CI	T-value	P-value
log NT pro-BNP	0.7	(0.57-0.83)	10.669	<0.001

Systolic blood pressure	0.457	(0.33-0.59)	6.994	<0.001
log bio-ADM	0.286	(0.15-0.42)	4.219	<0.001
Age	-0.148	(-0.28--0.02)	-2.219	0.027
Jugular venous distention	-0.271	(-0.54-0)	-1.99	0.047

N = 531

R² = 0.254

NYHA IV validation

Variable	Standardised Beta	95% CI	T-value	P-value
log NT pro-BNP	0.518	(0.27-0.76)	4.133	<0.001
Systolic Blood Pressure	0.371	(0.18-0.57)	3.741	<0.001
History of diabetes	0.493	(0.04-0.94)	2.167	0.032
log Serum creatinine	0.221	(0-0.44)	1.996	0.047
Heart rate	0.215	(0-0.43)	1.975	0.05

N = 186

R² = 0.228

Supplementary table 3a: comparison of variable selection using LASSO and stepwise backwards selection for the entire cohort:

Variable	Index Cohort		Validation Cohort	
	Backward stepwise	LASSO >15% miss excluded (lambda 1se)	Backward stepwise	LASSO >15% miss excluded (lambda 1se)
log NT pro-BNP	x	x	x	x
log Urinary KIM-1	x	x		
Log Plasma Urea	x			
FE of Urea	x			
Hx of Diabetes Mellitus	x	x	x	x
Systolic Blood Pressure	x	x	x	x
log bio-ADM	x	x	x	x
log Renin	x	x		
Log Urinary NGAL	x	x		
Creatinine		x	x	
Log GDF-15		x		x
Hypertension		x		
Log UroM		x		
FGF-23		x		
y-GT			x	x
VAS			x	X
BMI			x	
Heart Rate			x	
Oedema			x	x

NYHA class IV				x
CA-125				x

Supplementary table 3b: comparison of variable selection using LASSO and stepwise backwards selection for the HFREF (LVEF <40%) subgroup:

Variable	Index HFREF		Validation HFREF	
	Stepwise backwards	LASSO >15% miss excluded (lambda 1se)	Stepwise backwards	LASSO >15% miss excluded (lambda 1se)
Log NT pro-BNP	x	x	x	x
Log plasma Urea	x			x
Log urinary KIM-1	x	x		
Log bio-ADM	x	x	x	
Systolic blood pressure	x	x	x	
History of Diabetes Mellitus	x	x	x	x
Log Renin	x	x		
Log Urinary NGAL	x	x		
Log fractional excretion of urea	x			
History of hypertension		x		x
Plasma Glucose	x			
FGF-23		x		
Log GDF-15		x		
Log UROM	x	x		
y-GT			x	
VAS dyspnoea score			x	
Peripheral oedema above knee				x
NYHA IV				x
Sodium				x

CA-125				x
Bilirubin			x	x

Variable	Index		Validation	
	Stepwise backwards selection	Index Lasso >15% miss excluded (lambda 1se)	Stepwise backwards selection	Validation Lasso >15% miss excluded (lambda 1se)
log NT pro-BNP	x	x	x	x
log KIM-1	x			
Hx of Diabetes Mellitus	x		x	
log Renin	x			
Creatinine	x			
log Uromodulin	x	x		
Periperal edema	x			
Betablocker use	x			
Renal disease		x		
Systolic Blood Pressure			x	x
Heart Rate				x
VAS				x
HDL				x
Bio-ADM			x	x
Glucose				x
CA-125	X			x

Supplementary table 3c: comparison of variable selection using LASSO and stepwise backwards selection for the HFpEF (LVEF \geq 50%) subgroup:

Supplementary Table 4a. Multivariable regression analysis using LASSO variable selection, index cohort:

Variable	Standardised regression coefficient (95% CI)	T-value	P-value
log NT pro BNP	0.34 (0.25-0.43)	7.274	<0.001
log GDF-15	0.325 (0.22-0.43)	6.186	<0.001
Systolic Blood Pressure	0.242 (0.16-0.32)	5.97	<0.001
log Urinary KIM-1	0.246 (0.16-0.33)	5.673	<0.001
History of Diabetes Mellitus	0.457 (0.29-0.62)	5.528	<0.001
log plasma Renin	-0.203 (-0.28--0.12)	-4.925	<0.001
log Bio-ADM	0.207 (0.12-0.29)	4.627	<0.001
log Serum Creatinine	0.087 (0.01-0.17)	2.116	0.034
history of hypertension	0.166 (0.01-0.32)	2.053	0.04
Log urinary NGAL	0.081 (0-0.16)	1.919	0.055
FGF-23	0.004 (-0.08-0.08)	0.088	0.93

Supplementary Table 4b. Multivariable regression analysis using LASSO variable selection, validation cohort:

Variable	Standardised regression coefficient (95% CI)	T-value	P-value
Systolic blood pressure	0.405 (0.32-0.49)	9.606	<0.001
log NT pro-BNP	0.473 (0.37-0.58)	8.864	<0.001
History of Diabetes Mellitus	0.428 (0.25-0.61)	4.645	<0.001
log Gamma-GT	0.156 (0.07-0.24)	3.494	<0.001
VAS Dyspnoea score	0.125 (0.03-0.22)	2.669	0.008
log GDF-15	0.118 (0.01-0.22)	2.189	0.029

log bio-ADM	0.108 (0.01-0.21)	2.065	0.039
log CA-125	0.108 (0-0.21)	2.047	0.041
Peripheral oedema above knees	0.328 (-0.06-0.72)	1.641	0.101
NYHA class IV	-0.057 (-0.31-0.2)	-0.439	0.661

Supplementary Table 4c. Multivariable regression analysis using LASSO variable selection, subgroup of patients with HFrEF (LVEF <40%):

Variable	Index Cohort			Validation Cohort		
	Standardised regression coefficient (95% CI)	T-value	P-value	Standardised regression coefficient (95% CI)	T-value	P-value
log NT pro-BNP	0.361 (0.25-0.47)	6.535	<0.001	0.487 (0.32-0.66)	5.59	<0.001
log GDF-15	0.346 (0.23-0.47)	5.686	<0.001			
Systolic Blood Pressure	0.256 (0.16-0.35)	5.145	<0.001			
log Urinary KIM-1	0.254 (0.15-0.36)	4.801	<0.001			
log bio-ADM	0.216 (0.11-0.32)	3.964	<0.001			
History of Diabetes Mellitus	0.36 (0.17-0.55)	3.678	<0.001	0.525 (0.22-0.83)	3.369	0.001
log Urinary Uromodulin	-0.17 (-0.26--0.08)	-3.594	<0.001			
log Renin	-0.138 (-0.23--0.04)	-2.837	0.005			
History of Hypertension	0.2 (0.02-0.38)	2.145	0.032	0.451 (0.18-0.73)	3.217	0.001
log Urinary NGAL	0.077 (-0.02-0.17)	1.539	0.124			
FGF-23	-0.02 (-0.11-0.06)	-0.471	0.637			
log Biliurubin				0.16 (0.01-0.31)	2.148	0.032
Serum Sodium				0.144 (0.01-0.28)	2.076	0.039
log CA125				0.14 (-0.02-0.3)	1.719	0.086
log Urea				0.102 (-0.04-0.25)	1.405	0.161
NYHA IV				-0.177 (-0.61-0.25)	-0.815	0.416
Peripheral oedema above knees				0.011 (-0.69-0.71)	0.03	0.976

Supplementary Table 4d. Multivariable regression analysis using LASSO variable selection, subgroup of patients with HFpEF (LVEF \geq 50%):

Variable	Index Cohort			Validation Cohort		
	Standardised regression coefficient (95% CI)	T-value	P-value	Standardised regression coefficient (95% CI)	T-value	P-value
Log NT pro-BNP	0.755 (0.36-1.15)	3.799	<0.001	0.622 (0.39-0.86)	5.247	<0.001
History of renal disease	0.967 (0.3-1.63)	2.876	0.005			
log Urinary Uromodulin	-0.278 (-0.58-0.02)	-1.843	0.068			
log Glucose				0.363 (0.2-0.52)	4.514	<0.001
Systolic Blood Pressure				0.333 (0.15-0.51)	3.626	<0.001
HDL-cholesterol				0.323 (0.15-0.5)	3.612	<0.001
VAS Dyspnoea score				0.192 (0.01-0.38)	2.048	0.042
Heart Rate				0.148 (-0.05-0.35)	1.462	0.145
log bio-ADM				0.14 (-0.06-0.34)	1.409	0.16
log CA-125				0.141 (-0.09-0.37)	1.219	0.224

Supplementary Table 5: multivariable linear regression analysis for history of diabetes subgroups

Index (N = 614)				Validation (N = 417)		
History of diabetes = YES						
Variable	Standardised regression coefficient (95% CI)	T value	p-value	Standardised regression coefficient 95% CI	T value	p-value
log NT pro-BNP	0.451 (0.28-0.62)	5.285	<0.001	0.548 (0.39-0.71)	6.68	<0.001
Systolic Blood Pressure	0.434 (0.27-0.6)	5.187	<0.001	0.55 (0.41-0.69)	7.508	<0.001
log Renin	-0.328 (-0.49--0.17)	-3.991	<0.001			
Bibasalar Rales				0.545 (0.23-0.85)	3.453	0.001
History of Atrial Fibrillation				0.483 (0.19-0.77)	3.28	0.001
log Serum Creatinin				0.253 (0.1-0.41)	3.18	0.002
VAS dyspnoea scale				0.236 (0.08-0.39)	3.058	0.002
Age				-0.25 (-0.43--0.07)	-2.727	0.007
log Urinary NGAL	0.205 (0.06-0.35)	2.843	0.005			
log Plasma FGF-23	0.256 (0.07-0.44)	2.704	0.007			
log ASAT				-0.281 (-0.51--0.06)	-2.452	0.015
log bio-ADM	0.196 (0.02-0.37)	2.157	0.031			
<i>Adjusted R² = 0.204</i>				<i>Adjusted R² = 0.323</i>		
History of diabetes = NO						
Index (N = 924)				Validation (N = 826)		
Variable	Standardised regression coefficient (95% CI)	T value	p-value	Standardised regression coefficient 95% CI	T value	p-value
log NT pro-BNP	0.463 (0.35-0.58)	8.121	<0.001	0.513 (0.4-0.62)	9.24	<0.001
Systolic Blood Pressure				0.336 (0.24-0.43)	6.968	<0.001
log bio-ADM	0.283 (0.17-0.39)	5.012	<0.001			
History of hypertension	0.421 (0.22-0.62)	4.098	<0.001			
log Bilirubin				0.179 (0.08-0.28)	3.566	<0.001
Serum Albumin	-0.163 (-0.27--0.06)	-3.1	0.002			
VAS dyspnoea scale				0.152 (0.06-0.25)	3.087	0.002
Heart Rate				0.144 (0.05-0.24)	2.924	0.004

Peripheral oedema above knees				0.554 (0.14-0.97)	2.616	0.009
History of malignancy				0.582 (0.13-1.03)	2.537	0.011
Body Mass Index				-0.134 (-0.24--0.03)	-2.481	0.013
Jugular venous distention	0.249 (0.02-0.48)	2.153	0.032			

Adjusted R² = 0.181

Adjusted R² = 0.248

Supplementary table 6: Multivariable logistic regression for any albuminuria

	Index			Validation		
	OR	95% CI	P-value	OR	95% CI	P-value
NT pro BNP (per 1000 units increase)	1.091	1.066 - 1.117	<0.001	1.103	1.055 - 1.160	<0.001
History of diabetes	1.575	1.266 - 1.961	<0.001	1.874	1.274 - 2.767	0.002
History of hypertension				1.898	1.301 - 2.787	<0.001
Bio-ADM (per 10 units increase)	1.035	1.013 - 1.060	0.003			
GDF-15 (per 1000 units increase)	1.009	1.005 - 1.013	<0.001			
Systolic blood pressure (per 10 units increase)	1.146	1.093 - 1.204	<0.001			
ACE- inhibitor use	0.783	0.623 - 0.986	0.037			
Aldosterone (per 10 units increase)	0.990	0.985 - 0.996	<0.001			
History of atrial fibrillation	1.257	1.024 - 1.544	0.029			
NYHA class IV	1.596	1.166 - 2.193	0.004			
Bilirubin (per 5 units increase)				1.183	1.063 - 1.323	0.003
Peripheral edema above knee				2.944	1.339 - 6.781	0.009
Body mass index				0.965	0.936 - 0.995	0.026
Tricuspid regurgitation rate (per 5 units increase)				1.079	1.009 - 1.158	0.029
Age (per 10 units increase)				1.226	1.015 - 1.489	0.037
Heart rate				1.011	1.000 - 1.021	0.043

Abbreviations: NT pro-BNP: N-terminal pro-B-type natriuretic peptide; bio-ADM: biologically active adrenomedullin; GDF-15: growth differentiation factor-15; ACE: angiotensin converter enzyme; NYHA: New York Heart Association;