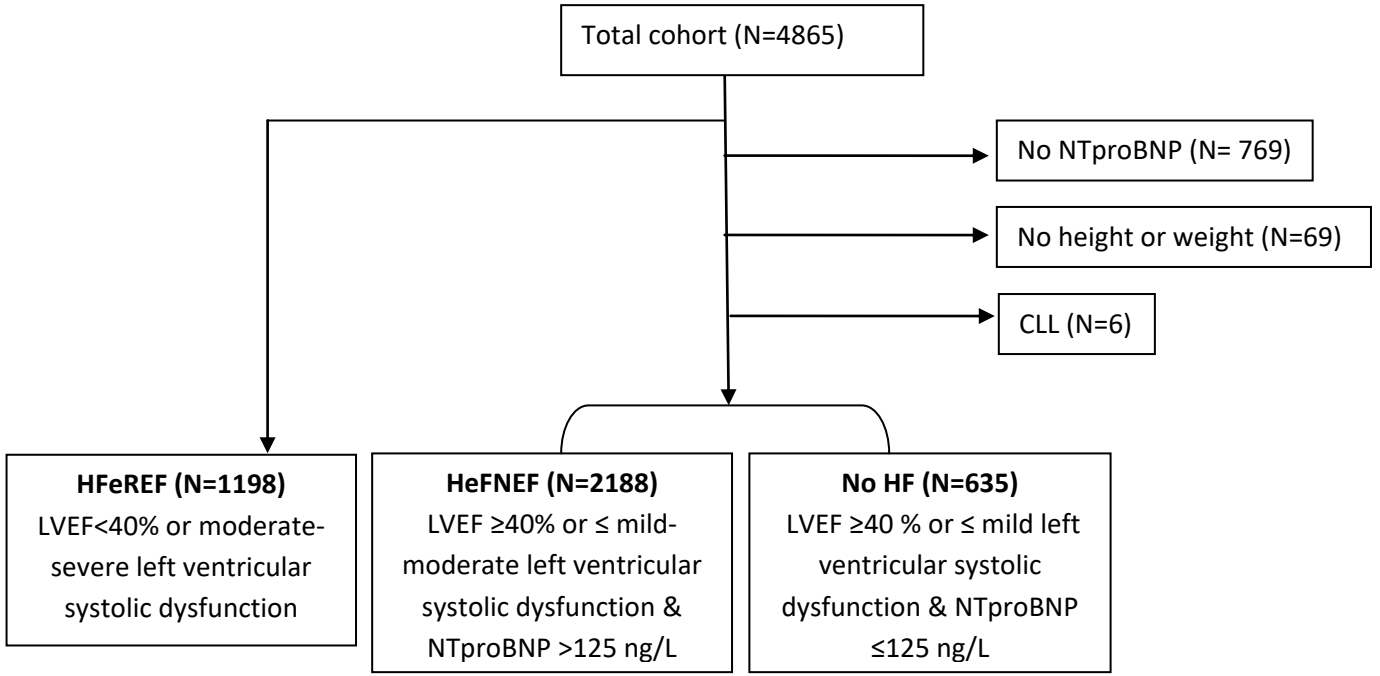
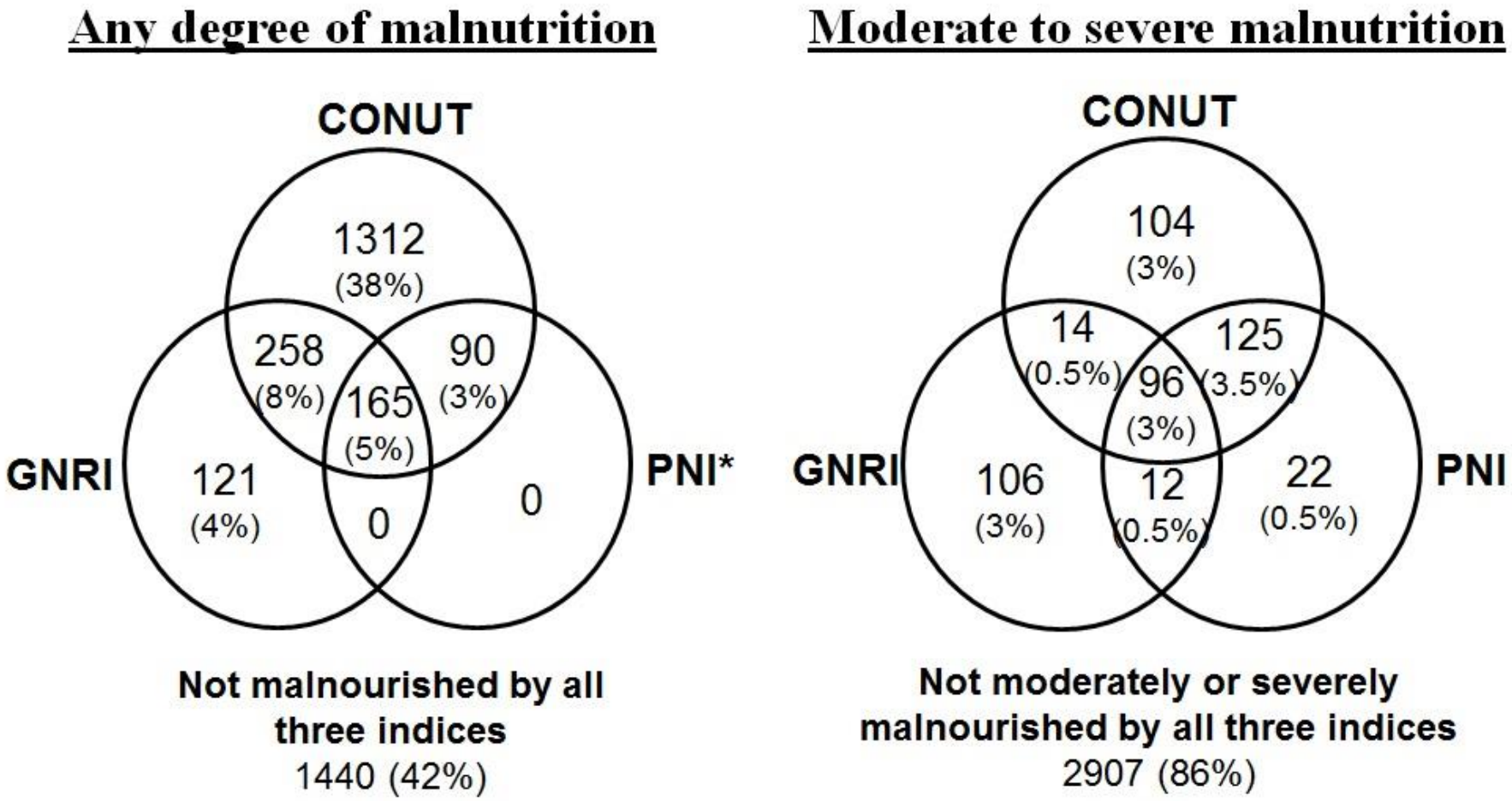
Online figure 1: Recruitment of chronic heart failure patients.



CLL = chronic lymphocytic leukaemia, HeFREF = heart failure with reduced ejection fraction, HeFNEF= heart failure with normal ejection fraction, HF= heart failure, LVEF= left ventricular ejection fraction, NTproBNP = N-terminal Pro Brain Natriuretic Peptide.

Online figure 2: Prevalence of malnutrition (any degree versus moderate to severe) in our HF cohort according to CONUT score, GNRI and PNI.



Online table 1: Procedures for evaluation of each nutritional index.

Nutritional Indices	**Degree of malnutrition**			
	Normal	**Mild**	**Moderate**	**Severe**
Controlling Nutritional Status (CONUT) score [9]				
Albumin, g/L (score)	≥35 (0)	30-34 (2)	25-29 (4)	<25 (6)
Cholesterol, mmol/L (score)	>4.65 (0)	3.62-4.65 (1)	2.59-3.61 (2)	<2.59 (3)
Total Lymphocyte count , $x10^9$/L (score)	≥1.60 (0)	1.20-1.59 (1)	0.80-1.19 (2)	<0.80 (3)
Overall score	0-1	2-4	5-8	9-12
Geriatric Nutritional risk index (GNRI) [10]				
= 1.489 x serum albumin (g/L) + 41.7 x (body weight in kilograms / ideal body weight)	>98	92-98	82-91	<82
Prognostic nutritional index (PNI) [11]				
= 10 x serum albumin (g/dL) + 0.005 x total lymphocyte count (mm^3)	>38	-	35-38	<35

Online table 2a: Baseline characteristics of the heart failure cohort by CONUT categories

	CONUT Score				Overall	Missing	P-value amongst malnutrition groups*
	0-1 Normal (N= 1561)	2-4 Mild malnutrition (N=1486)	5-8 Moderate malnutrition (N=319)	9-12 Severe malnutrition (N=20)	Median (25^{th}, 75^{th} centiles) or n (%) (N=3386)		
Age (years)	73 (65-80)	75 (69-81)	77 (71-82)	78 (69-83)	75 (67-81)	-	<0.001
Sex (male), n(%)	851 (55)	964 (65)	233 (73)	15 (75)	2063 (61)	-	<0.001
Height (m)	1.66 (1.58-1.74)	1.68 (1.60-1.74)	1.68 (1.61-1.75)	1.70 (1.61-1.76)	1.67 (1.59-1.74)	-	0.012
Weight (kg)	79 (68-91)	79 (67-91)	75 (64-87)	70 (65-86)	78 (67-91)	-	0.037
BMI (kg/m^2)	29 (25-32)	28 (25-32)	26(24-30)	25 (22-30)	28 (25-32)	-	<0.001
BP systolic (mmHg)	140 (124-160)	139 (121-156)	126 (110-149)	105 (94-119)	139 (121-157)	4	<0.001
BP diastolic (mmHg)	80 (71-90)	77 (68-87)	72 (63-81)	60 (56-70)	78 (69-88)	3	<0.001
HR (bpm)	72 (63-84)	71 (62-84)	78 (64-89)	78 (70-88)	72 (62-85)	13	0.001
NYHA, n(%)						-	<0.001
I	388 (25)	291 (20)	31 (10)	1 (5)	711 (21)		
II	817 (52)	705 (47)	132 (41)	6 (30)	1660 (49)		
III	336 (22)	463 (31)	142 (45)	11 (55)	952 (28)		

IV	20 (1)	27 (2)	14 (4)	2 (10)	63 (2)		
Hb (g/dL)	13.7 (12.7-14.8)	13.1 (12.0-14.2)	11.8 (10.6-12.9)	10.8 (9.6-12.9)	13.3 (12.1-14.4)	10	<0.001
Urea (mmol/L)	6.4 (5.0-8.6)	7.0 (5.3-9.5)	8.5 (6.1-12.5)	10.6 (8.2-12.5)	6.8 (5.2-9.3)	1	<0.001
Creatinine (umol/L)	94 (79-115)	103 (83-129)	117 (91-162)	134 (97-177)	100 (81-126)	7	<0.001
K+ (mmol/L)	4.3 (4.1-4.7)	4.3 (4.0-4.6)	4.3 (4.0-4.7)	4.1 (3.9-4.6)	4.3 (4.0-4.6)	18	0.051
Na+ (mmol/L)	139 (137-141)	139 (136-140)	138 (135-140)	135 (133-138)	139 (137-140)	5	<0.001
Lymphocyte ($x10^9$/L)	1.9 (1.7-2.3)	1.4 (1.1-1.8)	1.1 (0.8-1.4)	0.6 (0.5-0.9)	1.6 (1.2-2.1)	-	<0.001
Albumin (g/L)	39 (37-41)	37 (35-39)	32 (29-34)	24 (22-28)	38 (35-40)	-	<0.001
Cholesterol (mmol/L)	5.1 (4.4-5.9)	4.0 (3.4-4.8)	3.5 (2.9-4.2)	2.9 (2.5-3.3)	4.5 (3.7-5.4)	-	<0.001
NTproBNP (ng/L)	790 (305-1772)	1291 (498-2935)	3873 (1516-7693)	6071 (2223-20466)	1103 (415-2631)	-	<0.001
Loop diuretic, n(%)	919 (59)	977 (67)	234 (74)	17 (85)	2147 (64)	34	<0.001
MRA, n(%)	266 (17)	309 (21)	50 (16)	6 (30)	631 (19)	34	0.012
ACEi, n(%)	891 (58)	884 (60)	170 (54)	7 (35)	1952 (58)	34	0.023
ARB, n(%)	187 (12)	169 (12)	33 (11)	3 (15)	392 (12)	34	0.82
ACEi or ARB, n(%)	1070 (69)	1033 (70)	203 (64)	9 (45)	2315 (69)	34	0.021
BB, n(%)	858 (55)	839 (57)	169 (54)	10 (50)	1876 (56)	34	0.57
Statin, n(%)	685 (44)	850 (58)	180 (57)	11 (55)	1726 (52)	34	<0.001

Digoxin, n(%)	248 (16)	253 (17)	80 (25)	6 (30)	587 (18)	34	<0.001
Cardiac rhythm, n(%)						-	<0.001
AF	380 (24)	465 (31)	119 (37)	9 (45)	973 (29)		
Sinus	1103 (71)	925 (62)	178 (56)	8 (40)	2214 (65)		
Unknown	78 (5)	96 (7)	22 (7)	3 (15)	199 (6)		
EF (%)	45 (33-56)	44 (33-56)	41 (29-52)	39 (30-55)	44 (33-56)	1558	0.038
LV impairment, n(%)						-	0.03
None/trivial	726 (47)	654 (44)	115 (36)	7 (35)	1502 (44)		
Mild/ mild-moderate	319 (20)	338 (23)	80 (25)	5 (25)	742 (22)		
Moderate-severe	561 (33)	494 (33)	124 (39)	8 (40)	1142 (34)		
HF phenotype, n(%)						-	0.024
HeFREF	552 (35)	507 (34)	129 (41)	10 (50)	1198 (35)		
HeFNEF	1009 (65)	979 (66)	190 (59)	10 (50)	2188 (65)		
LVEDD (cm)	5.3 (4.7-6.1)	5.4 (4.8-6.1)	5.4 (4.8-6.2)	5.6 (4.8-6.2)	5.4 (4.8-6.1)	517	0.49
CVA, n(%)	91 (6)	107 (7)	36 (11)	3 (15)	237 (7)	-	0.002
IHD, n(%)	666 (43)	775 (52)	154 (48)	11 (55)	1606 (48)	-	<0.001

PVD, n(%)	54 (4)	70 (5)	22 (7)	0	146 (4)	-	0.025
Diabetes, n(%)	310 (21)	411 (29)	96 (32)	2 (11)	819 (26)	-	<0.001
Reduced mobility, n(%)	739 (56)	859 (67)	210 (76)	15 (94)	1823 (63)	-	<0.001
HTN, n (%)	593 (38)	549 (37)	97 (30)	6 (30)	1245 (37)	-	0.07
COPD, n (%)	136 (9)	150 (10)	37 (12)	2 (10)	325 (10)	-	0.35
Cancer, n (%)	131 (8)	133 (9)	32 (10)	6 (30)	302 (9)	-	0.008
Significantly deranged liver function test, n (%)	7 (0)	3 (0)	5 (2)	1 (5)	16 (1)	-	<0.001

Online table 2b: Baseline characteristics of the heart failure cohort by GNRI categories

	GNRI				Overall	Missing	P-value amongst malnutrition groups*
	>98 Normal (N= 2842)	92-98 Mild malnutrition (N=316)	82-91 Moderate malnutrition (N=177)	<82 Severe malnutrition (N=51)	Median (25^{th}, 75^{th} centiles) or n (%) (N=3386)		
Age (years)	74 (67-80)	78 (72-84)	78 (72-83)	79 (74-84)	75 (67-81)	-	<0.001
Sex (male) , n(%)	1757 (62)	182 (58)	97 (55)	27 (53)	2063 (61)	-	0.086
Height (m)	1.67 (1.59-1.75)	1.66 (1.58-1.72)	1.65 (1.58-1.72)	1.65 (1.58-1.76)	1.67 (1.59-1.74)	-	0.006
Weight (kg)	82 (71-94)	63 (56-69)	57(49-66)	55 (43-61)	78 (67-91)	-	<0.001
BMI (kg/m^2)	29 (26-33)	23 (21-24)	21 (19-23)	19 (17-21)	28 (25-32)	-	<0.001
BP systolic (mmHg)	140 (123-158)	133 (116-151)	123 (109-148)	118 (103-136)	139 (121-157)	4	<0.001
BP diastolic (mmHg)	79 (70-89)	74 (65-84)	70 (60-79)	68 (58-76)	78 (69-88)	3	<0.001
HR (bpm)	72 (62-84)	77 (66-88)	77 (64-90)	82 (74-90)	72 (62-85)	13	<0.001
NYHA, n(%) I II III	 616 (22) 1418 (50) 762 (27)	 64 (20) 144 (46) 101 (32)	 26 (15) 82 (46) 61 (34)	 5 (10) 16 (31) 28 (55)	 711 (21) 1660 (49) 952 (28)	-	<0.001

IV	46 (1)	7 (2)	8 (5)	2 (4)	63 (2)		
Hb (g/dL)	13.5 (12.3-14.5)	12.6 (11.4-13.8)	12.5 (11.1-13.5)	12.0 (10.4-13.4)	13.3 (12.1-14.4)	10	<0.001
Urea (mmol/L)	6.7 (5.2-9.2)	7.1 (5.4-10.5)	7.5 (5.6-10.5)	8.4 (5.5-11.3)	6.8 (5.2-9.3)	1	0.003
Creatinine (umol/L)	100 (82-125)	100 (79-131)	101 (77-131)	107 (79-137)	100 (81-126)	7	0.87
K+ (mmol/L)	4.3 (4.1-4.7)	4.4 (4.1-4.6)	4.3 (4.0-4.7)	4.3 (3.8-4.6)	4.3 (4.0-4.6)	18	0.37
Na+ (mmol/L)	139 (137-141)	138 (136-140)	137 (134-139)	136 (134-139)	139 (137-140)	5	<0.001
Lymphocyte ($x10^9$/L)	1.7 (1.3-2.1)	1.4 (1.1-1.8)	1.4 (1.0-1.7)	1.2 (0.9-1.6)	1.6 (1.2-2.1)	-	<0.001
Albumin (g/L)	38 (36-40)	35 (33-37)	32 (30-35)	29 (24-30)	38 (35-40)	-	<0.001
Cholesterol (mmol/L)	4.5 (3.7-5.4)	4.5 (3.6-5.4)	4.4 (3.6-5.2)	4.3 (3.6-5.1)	4.5 (3.7-5.4)	-	0.04
NTproBNP (ng/L)	930 (364-2167)	2518 (1104-4757)	3016 (1266-7428)	4854 (1787-9447)	1103 (415-2631)	-	<0.001
Loop diuretic, n(%)	1764 (63)	213 (68)	129 (73)	41 (85)	2147 (64)	34	<0.001
MRA, n(%)	536 (19)	56 (18)	31 (18)	8 (17)	631 (19)	34	0.901
ACEi, n(%)	1641 (58)	181 (58)	108 (61)	22 (46)	1952 (58)	34	0.29
ARB, n(%)	361 (13)	15 (5)	11 (6)	5 (10)	392 (12)	34	<0.001
ACEi or ARB, n(%)	1976 (70)	194 (62)	119 (68)	26 (54)	2315 (69)	34	0.003
BB, n(%)	1614 (57)	161 (51)	83 (47)	18 (38)	1876 (56)	34	0.001
Statin, n(%)	1529 (54)	121 (39)	56 (34)	17 (35)	1726 (52)	34	<0.001

Digoxin, n(%)	442 (16)	88 (28)	42 (24)	15 (31)	587 (18)	34	<0.001
Cardiac rhythm, n(%)						-	0.11
AF	803 (28)	100 (32)	52 (30)	18 (35)	973 (29)		
Sinus	1872 (66)	193 (61)	121 (68)	28 (55)	2214 (65)		
Unknown	167 (6)	23 (7)	4 (2)	5 (10)	199 (6)		
EF (%)	45 (34-57)	39 (29-50)	41 (29-47)	37 (29-50)	44 (33-56)	1558	<0.001
LV impairment, n (%)						0	0.001
None/trivial	1300 (46)	124 (39)	60 (34)	18 (35)	1502 (44)		
Mild/ mild-moderate	624 (22)	61 (19)	47 (27)	10 (20)	742 (22)		
Moderate- severe	918 (32)	131 (42)	70 (39)	23 (45)	1142 (34)		
HF phenotype, n(%)						-	0.001
HeFREF	969 (34)	133 (42)	71 (40)	25 (49)	1198 (35)		
HeFNEF	1873 (66)	183 (58)	106 (60)	26 (51)	2188 (65)		
LVEDD (cm)	5.4 (4.8-6.1)	5.3 (4.7-6.1)	5.3 (4.7-6.2)	5.0 (4.4-5.9)	5.4 (4.8-6.1)	517	0.042
CVA, n(%)	188 (7)	32 (10)	12 (7)	5 (10)	237 (7)	-	0.11
IHD, n(%)	1364 (48)	141 (45)	76 (43)	25 (49)	1606 (48)	-	0.42

PVD, n(%)	115 (4)	17 (5)	13 (7)	1 (2)	146 (4)	-	0.11
Diabetes, n(%)	745 (28)	45 (15)	24 (15)	5 (10)	819 (26)	-	<0.001
Reduced mobility, n(%)	1507 (62)	170 (62)	111 (73)	35 (83)	1823 (63)	-	0.013
HTN, n (%)	1091 (38)	101 (32)	46 (26)	7 (14)	1245 (37)	-	<0.001
COPD, n (%)	240 (8)	39 (12)	38 (22)	8 (16)	325 (10)	-	<0.001
Cancer, n (%)	245 (9)	29 (9)	18 (10)	10 (20)	302 (9)	-	0.05
Significantly deranged liver function test, n (%)	12 (0)	2 (1)	2 (1)	0	16 (1)	-	0.53

Online table 2c: Baseline characteristics of the heart failure cohort by PNI categories

	PNI			Overall	Missing	P-value amongst malnutrition groups*
	>38 Normal (N= 3131)	35-38 Moderate malnutrition (N=139)	<35 Severe malnutrition (N=116)	Median (25^{th}, 75^{th} centiles) or n (%) (N=3386)		
Age (years)	75 (67-81)	75 (68-82)	78 (72-82)	75 (67-81)	-	0.004
Sex (male) , n(%)	1888 (60)	95 (68)	80 (69)	2063 (61)	-	0.032
Height (m)	1.67 (1.59-1.74)	1.68 (1.62-1.73)	1.68 (1.61-1.77)	1.67 (1.59-1.74)	-	0.097
Weight (kg)	79 (67-91)	74 (65-86)	72 (61-88)	78 (67-91)	-	0.002
BMI (kg/m^2)	28 (25-32)	26 (24-29)	26 (22-30)	28 (25-32)	-	<0.001
BP systolic (mmHg)	139 (122-158)	124 (111-146)	125 (105-152)	139 (121-157)	4	<0.001
BP diastolic (mmHg)	78 (69-89)	73 (63-81)	70 (59-81)	78 (69-88)	3	<0.001
HR (bpm)	72 (62-84)	77 (69-90)	80 (68-92)	72 (62-85)	13	<0.001
NYHA, n(%) I II	 692 (22) 1563 (50)	 11 (8) 59 (42)	 8 (7) 38 (33)	 711 (21) 1660 (49)	-	<0.001

III IV	829 (26) 47 (2)	58 (42) 11 (8)	65 (56) 5 (4)	952 (28) 63 (2)		
Hb (g/dL)	13.4 (12.3-14.5)	12.0 (10.7-13.0)	11.6 (10.1-12.8)	13.3 (12.1-14.4)	10	<0.001
Urea (mmol/L)	6.7 (5.2-9.2)	7.5 (5.3-11.4)	9.2 (6.5-12.3)	6.8 (5.2-9.3)	1	<0.001
Creatinine (umol/L)	99 (81-124)	111 (83-147)	120 (92-169)	100 (81-126)	7	<0.001
K+ (mmol/L)	4.3 (4.1-4.7)	4.3 (3.9-4.6)	4.3 (3.9-4.6)	4.3 (4.0-4.6)	18	0.01
Na+ (mmol/L)	139 (137-141)	137 (135-139)	136 (134-139)	139 (137-140)	5	<0.001
Lymphocyte ($x10^9$/L)	1.3 (1.7-2.1)	1.1 (0.8-1.4)	0.9 (0.6-1.3)	1.6 (1.2-2.1)	-	<0.001
Albumin (g/L)	38 (36-40)	31 (30-33)	27 (25-30)	38 (35-40)	-	<0.001
Cholesterol (mmol/L)	4.5 (3.8-5.4)	3.9 (3.2-4.6)	3.8 (3.0-4.7)	4.5 (3.7-5.4)	-	<0.001
NTproBNP (ng/L)	1008 (387-2355)	3319 (1294-7634)	5365 (1907-11284)	1103 (415-2631)	-	<0.001
Loop diuretic, n(%)	1957 (63)	101 (73)	89 (80)	2147 (64)	34	<0.001
MRA, n(%)	594 (19)	19 (14)	18 (16)	631 (19)	34	0.22
ACEi, n(%)	1837 (59)	68 (49)	47 (42)	1952 (58)	34	<0.001
ARB, n(%)	364 (12)	11 (8)	17 (15)	392 (12)	34	0.21
ACEi or ARB, n(%)	2173 (70)	79 (57)	63 (56)	2315 (69)	34	<0.001
BB, n(%)	1761 (57)	65 (47)	50 (45)	1876 (56)	34	0.004

Statin, n(%)	1615 (52)	61 (44)	50 (45)	1726 (52)	34	0.066
Digoxin, n(%)	515 (17)	45 (33)	27 (24)	587 (18)	34	<0.001
Cardiac rhythm, n(%)					-	0.001
AF	874 (28)	51 (37)	48 (41)	973 (29)		
Sinus	2078 (66)	76 (55)	60 (52)	2214 (65)		
Unknown	179 (6)	12 (8)	8 (7)	199 (6)		
EF (%)	45 (33-56)	41 (30-54)	42 (28-50)	44 (33-56)	1558	0.10
LV impairment, n(%)					0	0.23
None/trivial	1401 (45)	56 (40)	45 (39)	1502 (44)		
Mild/mild-moderate	685 (22)	26 (19)	31 (27)	742 (22)		
Moderate-severe	1045 (33)	57 (41)	40 (34)	1142 (34)		
HF phenotype, n(%)					-	0.54
HeFREF	1101 (35)	53 (38)	44 (38)	1198 (35)		
HeFNEF	2030 (65)	86 (62)	72 (62)	2188 (65)		
LVEDD (cm)	5.4 (4.8-6.1)	5.5 (4.8-6.2)	5.3 (4.6-6.1)	5.4 (4.8-6.1)	517	0.46
CVA, n(%)	207 (7)	16 (12)	14 (12)	237 (7)	-	0.008

IHD, n(%)	1499 (48)	55 (40)	52 (45)	1606 (48)	-	0.14
PVD, n(%)	130 (4)	10 (7)	6 (5)	146 (4)	-	0.20
Diabetes, n(%)	755 (25)	34 (27)	30 (28)	819 (26)	-	0.91
Reduced mobility, n(%)	1646 (62)	101 (82)	76 (80)	1823 (63)	-	<0.001
HTN, n (%)	1166 (37)	42 (30)	37 (32)	1245 (37)	-	0.13
COPD, n (%)	287 (9)	27 (19)	11 (10)	325 (10)	-	<0.001
Cancer, n (%)	269 (9)	19 (14)	14 (12)	302 (9)	-	0.06
Significantly deranged liver function test,n (%)	11 (0)	3 (2)	2 (2)	16 (1)	-	0.001

ACEi = Angiotensin-converting enzyme inhibitor, AF= atrial fibrillation, ARB = Angiotensin receptor blocker, BB= betablocker, BMI= body mass index, BP= blood pressure, CONUT = Controlling nutritional status, CVA = cerebrovascular disease, ECG= electrocardiogram. EF= ejection fraction, GNRI = Geriatric nutritional risk index, Hb = Haemoglobin, HF= heart failure, HeFREF = heart failure with reduced ejection fraction, HeFNEF = heart failure with normal ejection fraction, HR= heart rate, IHD = ischaemic heart disease, K+ = potassium, LVEDD= left ventricular end diastolic diameter, MRA = Mineralocorticoids receptor antagonists, Na+ = sodium, NYHA = New York Heart Association Class, NTproBNP = N-terminal Pro Brain Natriuretic Peptide, PNI = Prognostic nutritional Index, PVD = peripheral vascular disease, COPD= chronic obstructive pulmonary disease, HTN= hypertension.

*P-value for trend except when there are $\geq$ 2 categories (e.g. NYHA class, cardiac rhythm etc)

Online table 3a: Univariable and multivariable analyses of factors predicting outcomes in patients with CHF with HeFREF.

Worse outcome per unitary increase	**HeFREF (LVEF <40)**					
	Univariable			**Multivariable**		
	HR(95%CI)	Wald X^2	P-value	HR(95%CI)	Wald X^2	P-value
Age (years)	1.06 (1.05-1.07)	186.3	<0.001	1.05 (1.04-1.06)	79.0	<0.001
Sex (male vs female)	1.07 (0.90-1.27)	0.6	0.44			
Height (m)	0.10 (0.05-0.21)	35.1	<0.001			
Weight (kg)	0.99 (0.98-0.99)	43.5	<0.001			
BMI (kg/m^2)	0.97 (0.95-0.98)	19.5	<0.001			
BP systolic (mmHg)	0.99 (0.99-1.00)	8.2	0.004			
BP diastolic (mmHg)	0.98 (0.98-0.99)	46.3	<0.001	0.99 (0.98-0.99)	12.4	<0.001
HR (bpm)	1.00 (1.00-1.01)	3.4	0.06			
NYHA III/IV vs I/II	1.79 (1.54-2.08)	57.9	<0.001	1.57 (1.33-1.85)	28.9	<0.001
Hb (g/dL)	0.85 (0.82-0.89)	55.3	<0.001	0.93 (0.87-0.98)	6.7	0.01

Urea (mmol/L)	1.05 (1.04-1.05)	101.2	<0.001	1.03 (1.01-1.06)	8.0	0.005
Creatinine (umol/L)	1.00 (1.00-1.00)	32.9	<0.001			
K+ (mmol/L)	0.87 (0.74-1.01)	3.2	0.07			
Na+ (mmol/L)	0.96 (0.94-0.98)	14.1	<0.001			
Lymphocyte ($x10^9$/L)	0.73 (0.65-0.82)	28.9	<0.001			
Albumin (g/L)	0.91 (0.90-0.93)	91.6	<0.001			
Cholesterol (mmol/L)	0.92 (0.87-0.98)	6.1	0.01			
Log NTproBNP (ng/L)	2.87 (2.49-3.32)	208.3	<0.001	2.03 (1.68-2.46)	53.4	<0.001
Loop diuretic (Y vs N)	1.87 (1.54-2.28)	39.8	<0.001			
MRA (Y vs N)	0.97 (0.82-1.15)	0.1	0.80			
ACEi (Y vs N)	0.88 (0.75-1.04)	2.4	0.13			
ARB (Y vs N)	1.04 (0.80-1.35)	0.1	0.77			
ACEi or ARB (Y vs N)	0.86 (0.72-1.04)	2.4	0.12			
BB (Y vs N)	0.69 (0.59-0.80)	23.5	<0.001			

Statin (Y vs N)	0.88 (0.76-1.03)	2.7	0.10			
Digoxin (Y vs N)	1.22 (1.01-1.48)	4.2	0.04			
Cardiac rhythm AF vs Sinus	1.39 (1.17-1.66)	13.4	<0.001			
EF (%)	0.97 (0.96-0.99)	17.0	<0.001			
LVEDD (cm)	0.95 (0.87-1.05)	1.0	0.31			
CVA (Y vs N)	1.36 (1.06-1.75)	5.8	0.02			
IHD (Y vs N)	1.36 (1.15-1.60)	13.3	<0.001	1.30 (1.09-1.54)	8.3	0.004
PVD (Y vs N)	1.90 (1.46-2.49)	22.3	<0.001	2.00 (1.50-2.66)	22.4	<0.001
Diabetes (Y vs N)	1.14 (0.96-1.36)	2.1	0.15			
Reduced mobility (Y vs N)	2.30 (1.93-2.73)	89.7	<0.001			
Prevalence of malnutrition <u>CONUT</u> Normal Mild malnutrition Moderate malnutrition Severe malnutrition	 1 1.53 (1.31-1.80) 2.45 (1.94-3.09) 4.87 (2.40-9.85)	 - 27.1 57.1 19.4	 - <0.001 <0.001 <0.001			

GNRI						
Normal	1	-	-	1.29 (1.13-1.46)	15.2	<0.001
Mild malnutrition	1.51 (1.20-1.90)	12.5	<0.001			
Moderate malnutrition	2.40 (1.81-3.18)	37.4	<0.001			
Severe malnutrition	8.17 (5.17-12.92)	80.9	<0.001			
PNI						
Normal	1	-	-			
Moderate malnutrition	2.31 (1.68-3.16)	26.8	<0.001			
Severe malnutrition	2.20 (1.55-3.13)	19.5	<0.001			

Online table 3b: Univariable and multivariable analyses of factors predicting outcomes in patients with HF with HeFNEF (LVEF >40 or mild/ mild-moderate left ventricular systolic dysfunction and NTProBNP >125ng/L.)

Worse outcome per unitary increase	**HeFNEF**					
	Univariable			**Multivariable**		
	HR(95%CI)	Wald X^2	P-value	HR(95%CI)	Wald X^2	P-value
Age (years)	1.06 (1.05-1.07)	223.2	<0.001	1.05 (1.04-1.06)	109.4	<0.001
Sex (male vs female)	1.22 (1.08-1.39)	1.2	0.001	1.46 (1.26-1.68)	26.6	<0.001
Height (m)	0.32 (0.18-0.57)	14.8	<0.001			
Weight (kg)	0.99 (0.98-0.99)	30.4	<0.001			
BMI (kg/m^2)	0.98 (0.97-0.99)	18.0	<0.001			
BP systolic (mmHg)	1.00 (0.99-1.00)	14.9	<0.001			
BP diastolic (mmHg)	0.98 (0.98-0.99)	74.8	<0.001	0.99 (0.99-1.00)	4.0	0.05
HR (bpm)	1.01 (1.00-1.01)	18.2	<0.001	1.01 (1.00-1.01)	7.8	0.005
NYHA III/IV vs I/II	2.15 (1.89-2.45)	134.6	<0.001	1.33 (1.07-1.66)	6.6	0.01
Hb (g/dL)	0.80 (0.77-0.83)	158.3	<0.001	0.93 (0.89-0.97)	9.8	0.002

Urea (mmol/L)	1.06 (1.06-1.07)	241.2	<0.001			
Creatinine (umol/L)	1.00 (1.00-1.01)	196.1	<0.001	1.00 (1.00-1.00)	7.9	0.005
K+ (mmol/L)	1.09 (0.96-1.25)	1.7	0.19			
Na+ (mmol/L)	0.93 (0.91-0.95)	62.9	<0.001	0.97 (0.96-0.99)	6.7	0.01
Lymphocyte ($x10^9$/L)	0.64 (0.57-0.71)	71.2	<0.001			
Albumin (g/L)	0.88 (0.87-0.90)	251.7	<0.001			
Cholesterol (mmol/L)	0.95 (0.90-1.00)	4.7	0.03			
Log NTproBNP (ng/L)	3.06 (2.70-3.47)	303.8	<0.001	1.74 (1.47-2.05)	41.1	<0.001
Loop diuretic (Y vs N)	2.20 (1.93-2.52)	131.2	<0.001			
MRA (Y vs N)	1.42 (1.19-1.70)	14.8	<0.001			
ACEi (Y vs N)	1.06 (0.93-1.20)	0.7	0.39			
ARB (Y vs N)	0.82 (0.67-1.01)	3.5	0.06			
ACEi or ARB (Y vs N)	1.00 (0.88-1.13)	0.005	0.94			
BB (Y vs N)	0.68 (0.60-0.77)	37.8	<0.001			

Statin (Y vs N)	0.68 (0.60-0.77)	35.5	<0.001			
Digoxin (Y vs N)	1.58 (1.36-1.83)	36.0	<0.001			
Cardiac rhythm AF vs Sinus	1.33 (1.17-1.53)	17.4	<0.001	1.23 (1.04-1.46)	5.9	0.02
EF (%)	0.98 (0.97-0.99)	12.2	0.51			
LVEDD (cm)	1.01 (0.93-1.10)	0.04	0.84			
CVA (Y vs N)	1.67 (1.34-2.08)	20.7	<0.001	1.40 (1.10-1.78)	7.7	0.006
IHD (Y vs N)	0.92 (0.81-1.05)	1.6	0.20	0.85 (0.74-0.98)	4.8	0.03
PVD (Y vs N)	1.62 (1.20-2.17)	10.1	0.001	1.45 (1.06-1.98)	5.4	0.02
Diabetes (Y vs N)	1.11 (0.96-1.30)	1.9	0.16			
Reduced mobility (Y vs N)	2.03 (1.76-2.35)	91.7	<0.001			
Prevalence of malnutrition <u>CONUT</u> Normal Mild malnutrition Moderate malnutrition Severe malnutrition	 1 1.62 (1.42-1.85) 3.35 (2.74-4.10) 22.0 (11.70-	 - 50.2 137.7 92.1	 - <0.001 <0.001 <0.001			

	41.50)					
GNRI						
Normal	1	-	-	1.18 (1.05-1.33)	7.4	<0.001
Mild malnutrition	1.86 (1.53-2.27)	38.7	<0.001			
Moderate malnutrition	2.86 (2.25-3.64)	72.5	<0.001			
Severe malnutrition	5.02 (3.25-7.75)	52.9	<0.001			
PNI						
Normal	1	-	-			
Moderate malnutrition	3.06 (2.38-3.94)	75.5	<0.001			
Severe malnutrition	3.69 (2.79-4.87)	84.4	<0.001			

ACEi = Angiotensin-converting enzyme inhibitor, AF= atrial fibrillation, ARB = Angiotensin receptor blocker, BB= betablocker, BMI= body mass index, BP= blood pressure, CONUT = Controlling nutritional status, CVA = cerebrovascular disease, ECG= electrocardiogram. EF= ejection fraction, GNRI = Geriatric nutritional risk index, Hb = Haemoglobin, HF= heart failure, HeFREF = heart failure with reduced ejection fraction, HeFNEF = heart failure with normal ejection fraction, HR= heart rate, IHD = ischaemic heart disease, K+ = potassium, LVEDD= left ventricular end diastolic diameter, MRA = Mineralocorticoids receptor antagonists, Na+ = sodium, NYHA = New York Heart Association Class, NTproBNP = N-terminal Pro Brain Natriuretic Peptide, PNI = Prognostic nutritional Index, PVD = peripheral vascular disease,Y = yes, N=no.

Online table 4. Crossvalidation (x) for all patients with chronic heart failure. Crossvalidation (z) for patients chronic heart failure with baseline treatment excluded.

Baseline variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	N	%
Age (years)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	25	100
	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	25	100
Sex (female vs male)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	25	100
	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	25	100
BMI (kg/m^2)																										0	0
																										0	0
BP systolic (mmHg)																										0	0
																										0	0
BP diastolic (mmHg)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	25	100
	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	25	100
HR (bpm)																										0	0
	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z		Z	Z	Z	Z	Z	Z	24	96
NYHA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	25	100

III/IV vs I/II	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	25	100
Hb (g/dL)					Z																					0 1	0 4
Urea (mmol/L)	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	25 25	100 100
Creatinine (umol/L)	Z														X		X			Z						2 2	8 8
K+ (mmol/L)																										0 0	0 0
Na+ (mmol/L)		Z	X	Z	Z	Z			X			X Z	X Z	X Z		X Z				Z	Z	Z	X	Z		7 12	28 48
Lymphocyte (x10^9/L)	Z	Z											X	X		Z										2 3	8 12
Albumin (g/L)	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	25 25	100 10
Cholesterol (mmol/L)	Z	Z		Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z		Z	Z	Z	Z	0 23	0 92

Log NTproBNP (ng/L)	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	25 25	100 100
Loop diuretic (Y vs N)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	25	100
MRA (Y vs N)																										0	0
ACEi or ARB (Y vs N)																										0	0
BB (Y vs N)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	25	100
Statin (Y vs N)	X	X	x	X			X	X	X	X	X				X	X			X	X	X		X	X		11	44
Digoxin (Y vs N)	X	X			X	X	X	X	X	X	X	X	X	X	X	X		X	X	X		X	X	X	X	21	84
Cardiac rhythm AF vs Sinus																										0 0	0 0
LVEDD (cm)																										0 0	0 0
CVA (Y vs N)	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	25 25	100 100
IHD (Y vs N)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	25	100

																									0	0
PVD (Y vs N)	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	25 25	100 100
CONUT category	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	25 25	100 100
GNRI <u>category</u>	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	25 25	100 100
PNI category	X Z	X Z	 Z	X Z	X Z	X Z	X Z	X 	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	X Z	 Z	 Z	 Z	X 	 	X Z	X Z	X 	X Z	19 20	76 80
#deaths all-cause	129 4 131 5	129 5 131 11	130 4 130 5	130 2 130 3	130 3 130 9	129 6 131 8	130 4 133 17	128 7 131 8	128 6 130 8	1303 1318	1288 1302	1296 1301	1302 1318	1302 1303	1298 1310	1290 1317	1286 1316	1295 1312	1299 1312	1295 1300	1298 1309	1305 1314	1295 1310	1303 1312	1299 1319		

ACEi = Angiotensin-converting enzyme inhibitor, ARB = Angiotensin receptor blocker, AF= atrial fibrillation, BB= betablocker, BMI= body mass index, BP= blood pressure, CONUT = Controlling nutritional status, CVA = cerebrovascular disease, EF= ejection fraction, GNRI = Geriatric nutritional risk index, Hb = Haemoglobin, HR= heart rate, IHD = ischaemic heart

disease, K+ = potassium, LVEDD= left ventricular end diastolic diameter, MRA = Mineralocorticoids receptor antagonists, Na+ = sodium, NTProBNP = N-terminal Pro Brain Natriuretic Peptide, NYHA = New York Heart Association Class, PNI = Prognostic nutritional Index, PVD = peripheral vascular disease.

Online table 5: Summary of findings from other studies which reported the role of malnutrition scores in predicting outcomes using different risk models.

Study	Number of patients	Outcome	Malnutrition tool	Country	Findings
Narumi et al[i] (2013)	388 patients with stable CHF	Cardiovascular death	GNRI, CONUT, PNI	Japan	MV model including age, gender, NYHA and BNP Severe CONUT score (HR 9.4), severe PNI score (HR 3.8) and severe GNRI score (HR 6.0) predicted cardiovascular events in MV analysis (all p <0.001).
Kaneko et al[ii] (2014)	438 patients with decompensated HF	All-cause mortality, HF hospitalisation, composite mortality and HF hospitalisation	GNRI	Japan	MV model including age ≥ 75 years, male gender, CKD, DCM, RAS-I, BNP≥ 1000 pg/mL, LVDd ≥ 55 mm. Lower GNRI (per unitary decrease) predicted all-cause mortality (UV: HR=2.2, p=0.004; MV: HR=2.0, p=0.009), HF hospitalisation (UV: HR=1.6, p=0.03; MV: HR=1.8, p=0.01), and composite endpoint (UV: HR=1.9, p=0.001; MV: HR=1.9, p=0.001), in both UV and MV analysis.
Kinugasa et al[iii] (2013)	152 patients with decompensated HFNEF	All-cause mortality	GNRI	Japan	MV model including age, sex, BNP and BUN, prior HF hospitalisation, Na, eGFR. BMI excluded as in GNRI. Lower GNRI (per unitary decrease) predicted increased mortality in UV (HR 0.95, p<0.001) and MV (HR 0.95, p<0.001) analysis. AUC of risk model (GNRI+ age+gender) was significantly higher

					compared to that of (BMI+ age+ gender). (AUC 0.75 (p= 0.049) vs 0.70 (reference))
Gouya et al[iv] (2014)	137 patients with stable chronic HF	All-cause mortality HF hospitalisation	NRI (patients grouped into 2 NRI groups (< or ≥ cut off) according to cut off point calculated based on ROC analysis to provide the greatest sum of sensitivity and specificity for mortality)	Austria	MV model including age, waist circumference, LVEF, SBP, ghrelin, adiponectin and the NRI (categorical variable), after adjusting for NTproBNP, NRI (HR = 2.4, p = 0.37) and waist circumference (HR = 1.1; p = 0.004) were significant predictors of mortality but not of HF hospitalisations.
Aziz et al[v] (2011)	1110 patients with decompensated HF	**Composite endpoint of all-cause mortality and HF hospitalisation**	NRI	USA	MV model including age, BMI, NRI, eGFR, CAD NRI (per unitary decrease) was the most significant predictor of outcome in both UV (HR 3.03, p<0.0001) and MV models (HR 3.1, p<0.0001). BMI was a significant predictor of outcome in UV model (HR 0.96; p<0001) but was insignificant in MV analysis (HR 1; p = 0.69).
Al-Najjar et al[vi] (2012)	538 patients with stable chronic HF	All-cause mortality	NRI	UK	BMI was not a significant predictor of outcome in UV analysis (HR 0.98, p=0.31). BMI not included in MV models (Age, urea, creat, LVF, WCC, NRI, Albumin, Hb, Na) as it is part of NRI score. NRI (per unitary increase) was a significant predictor of outcome both UV (HR 0.98, p<0.001 & MV analyses (HR 0.95, p<0.001).

MV= multivariable, UV= univariable, NRI = nutritional risk index (NRI = (1.519 × serum albumin, g/dL) ,+ {41.7 × present weight (kg)/ideal body weight(kg), GNRI= geriatric nutritional risk index, PNI= prognostic nutritional index, CONUT= controlling nutritional status score, NYHA = New York Association functional class, eGFR = estimated glomerular filtration rate, CAD= coronary artery disease, LVEF= left ventricular ejection fraction, WCC= white cell count, Hb= haemoglobin, Na = sodium, LVF= left ventricular function, HFNEF= heart failure with normal ejection fraction, BUN= blood urea nitrogen, AUC = area under curve, CKD = chronic kidney disease, DCM = dilated caradiomyopathy, RAS-I = renin-angiotensin system inhibitor, BNP= brain natriuretic peptide, LVDd = left ventricular diastolic dimension.

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