

Supplemental figures and tables

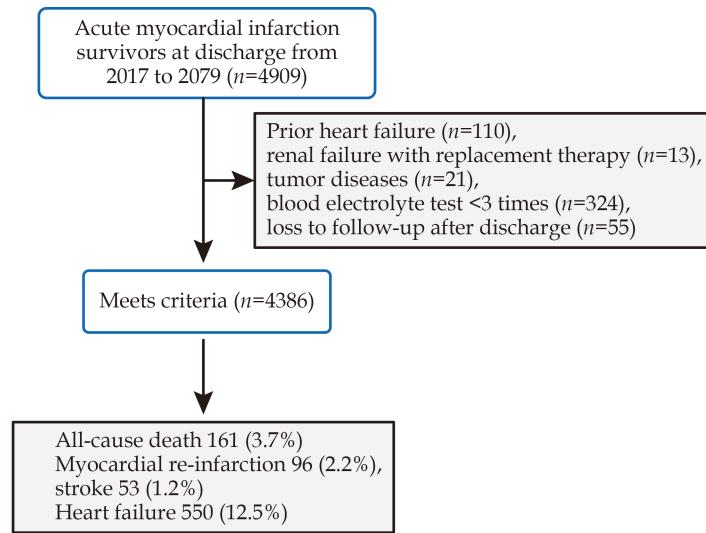


Figure 1S Flow diagram.

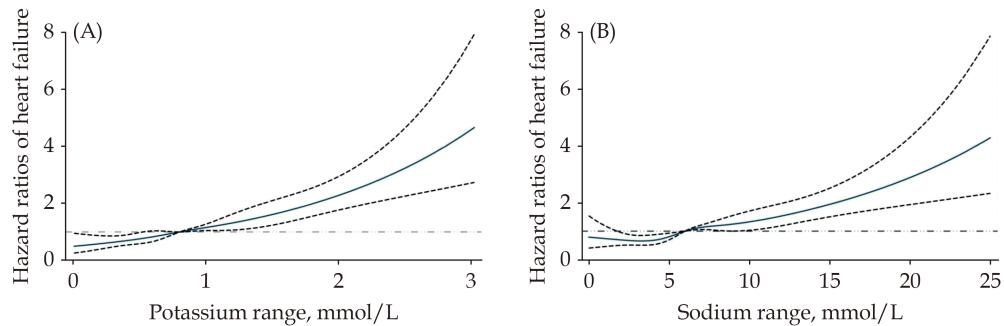


Figure 2S Restricted cubic spline curve between potassium or sodium variability and risks of HF after admission Restricted cubic spline curve indicates the age- and sex-adjusted HRs (95%CI) estimated by Cox proportional remodelling, setting the median value (0.8 mmol/L for potassium range and 6.0 mmol/L for sodium range) as reference. Knots include the 5th, 25th, 50th, 75th, and 95th percentiles of potassium or sodium range. Solid line represents point estimates. Dashed line represents 95% CIs.

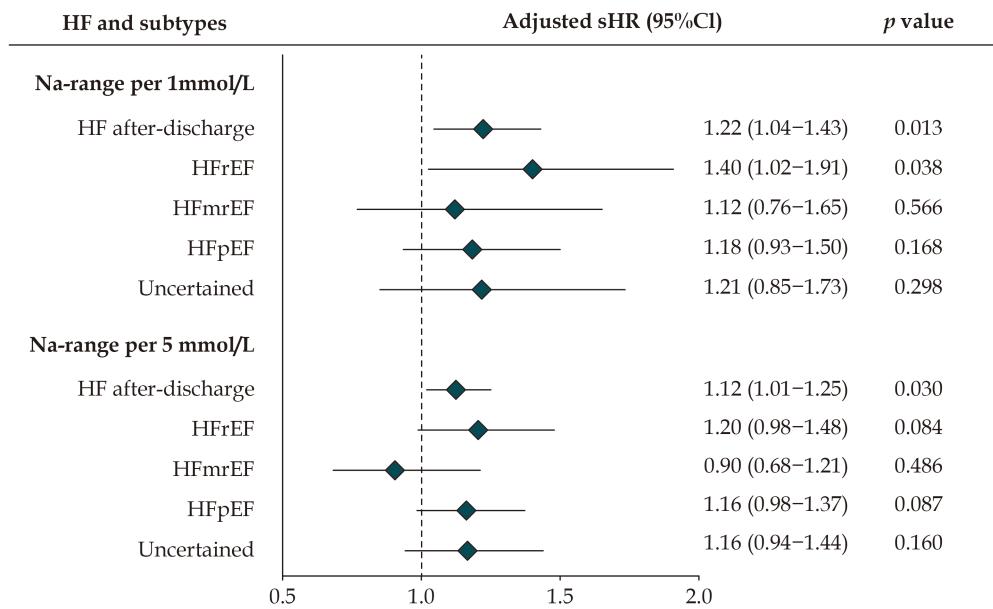


Figure 3S Prediction of potassium or sodium variability for each subtype of heart failure post AMI hospitalization sHR was estimated using Fine-Gray competing risk model adjusted for age, sex, BMI, smoking, hypertension, diabetes, prior MI, cTnI, NTpro-BNP, CRP, eGFR, TG, TC, HDL, MI type, anterior MI, PCI, ACEI or ARB, spironolactone, acute heart failure and mean potassium or sodium level. CI, confidence interval; HFmrEF, heart failure with mid-range ejection fraction; HFpEF, heart failure with preserved ejection fraction; HFrEF, heart failure with reduced ejection fraction; K, kalium, potassium; Na, natrium, sodium; sHR, sub-distribution hazards ratio.

Table 1S The association between total mortality and electrolyte variability assessed by SD, CV and range.

All-cause death	Crude HR(95%CI)	P-value	Model I HR(95%CI)	P-value	Model II HR(95%CI)	P-value	Model III HR(95%CI)	P-value
Potassium variability								
SD		0.000		0.000		0.002		0.002
Q1	1(ref.)		1(ref.)		1(ref.)		1(ref.)	
Q2	2.03 (1.12–3.70)		1.97 (1.09–3.59)		1.57 (0.86–2.88)		1.56 (0.85–2.86)	
Q3	2.51 (1.41–4.48)		2.43 (1.36–4.33)		1.63 (0.90–2.94)		1.62 (0.90–2.93)	
Q4	4.23 (2.46–7.27)		4.09 (2.37–7.04)		2.36 (1.34–4.14)		2.33 (1.32–4.09)	
CV		0.000		0.000		0.001		0.001
Q1	1(ref.)		1(ref.)		1(ref.)		1(ref.)	
Q2	2.15 (1.19–3.88)		2.06 (1.14–3.72)		1.66 (0.91–3.04)		1.66 (0.91–3.04)	
Q3	2.63 (1.48–4.66)		2.56 (1.44–4.54)		1.72 (0.96–3.08)		1.71 (0.95–3.07)	
Q4	3.95 (2.29–6.81)		3.94 (2.28–6.81)		2.45 (1.40–4.29)		2.45 (1.40–4.29)	
Range		0.000		0.000		0.001		0.001
Q1	1(ref.)		1(ref.)		1(ref.)		1(ref.)	
Q2	1.88 (1.05–3.35)		1.85 (1.04–3.30)		1.48 (0.82–2.67)		1.47 (0.82–2.66)	
Q3	1.97 (1.09–3.56)		1.88 (1.04–3.40)		1.36 (0.74–2.48)		1.35 (0.74–2.47)	
Q4	4.54 (2.69–7.67)		4.39 (2.60–7.43)		2.38 (1.38–4.13)		2.35 (1.36–4.08)	
Sodium variability								
SD		0.000		0.003		0.614		0.642
Q1	1(ref.)		1(ref.)		1(ref.)		1(ref.)	
Q2	1.28 (0.78–2.12)		1.19 (0.72–1.97)		0.96 (0.58–1.60)		0.95 (0.57–1.58)	
Q3	1.58 (0.97–2.56)		1.42 (0.88–2.31)		1.00 (0.60–1.64)		0.99 (0.60–1.64)	
Q4	2.24 (1.41–3.54)		1.91 (1.20–3.02)		1.10 (0.68–1.77)		1.09 (0.67–1.75)	
CV		0.000		0.001		0.465		0.539
Q1	1(ref.)		1(ref.)		1(ref.)		1(ref.)	
Q2	1.20 (0.73–1.98)		1.13 (0.69–1.86)		0.91 (0.55–1.51)		0.90 (0.54–1.49)	
Q3	1.30 (0.80–2.14)		1.19 (0.73–1.96)		0.87 (0.52–1.44)		0.85 (0.51–1.41)	
Q4	2.41 (1.54–3.76)		2.06 (1.32–3.23)		1.15 (0.72–1.83)		1.11 (0.69–1.78)	
Range		0.000		0.000		0.503		0.504
Q1	1(ref.)		1(ref.)		1(ref.)		1(ref.)	
Q2	0.73 (0.43–1.26)		0.71 (0.42–1.22)		0.57 (0.33–0.98)		0.56 (0.32–0.96)	
Q3	1.54 (0.98–2.44)		1.42 (0.90–2.25)		0.97 (0.60–1.56)		0.96 (0.60–1.55)	
Q4	2.16 (1.40–3.32)		1.85 (1.20–2.86)		0.95 (0.60–1.51)		0.94 (0.59–1.49)	

CI, confidence interval; HR, hazards ratio. Model I: adjusted for age and sex. Model II: adjusted for model 1 plus BMI, smoking, hypertension, diabetes, prior MI, cTnI, NTpro-BNP, CRP, eGFR, TG, TC, HDL, MI type, anterior MI, PCI, ACEI or ARB, spironolactone and acute heart failure. Model III: adjusted for model 1 plus mean potassium or sodium level.

Table 2S The association between incidence of myocardial re-infarction or stroke and electrolyte variability.

Myocardial re-infarction		Q1	Q2	Q3	Q4	P trend
K variability						
VIM	1(ref.)	1.36 (0.71–2.60)	1.66 (0.88–3.12)	1.39 (0.72–2.69)	0.280	
SD	1(ref.)	1.66 (0.89–3.12)	1.34 (0.69–2.60)	1.48 (0.76–2.87)	0.415	
CV	1(ref.)	1.52 (0.80–2.87)	1.55 (0.81–2.95)	1.40 (0.72–2.71)	0.367	
Range	1(ref.)	2.00 (1.03–3.90)	2.13 (1.07–4.24)	1.93 (0.95–3.94)	0.097	
Na variability						
VIM	1(ref.)	1.10 (0.58–2.08)	1.30 (0.70–2.39)	1.31 (0.70–2.45)	0.330	
SD	1(ref.)	1.22 (0.65–2.27)	1.25 (0.68–2.32)	1.26 (0.67–2.37)	0.488	
CV	1(ref.)	1.24 (0.67–2.31)	1.21 (0.65–2.27)	1.36 (0.72–2.54)	0.382	
Range	1(ref.)	1.01 (0.53–1.93)	1.23 (0.65–2.31)	1.65 (0.90–3.04)	0.080	
Stroke						
K variability		Q1	Q2	Q3	Q4	p trend
VIM	1(ref.)	1.92 (0.83–4.45)	1.15 (0.46–2.90)	1.27 (0.52–3.13)	0.930	
SD	1(ref.)	1.80 (0.76–4.25)	1.48 (0.61–3.59)	1.23 (0.49–3.08)	0.926	
CV	1(ref.)	1.83 (0.78–4.29)	1.16 (0.46–2.92)	1.40 (0.58–3.42)	0.833	
Range	1(ref.)	1.68 (0.71–3.98)	1.38 (0.55–3.43)	1.47 (0.59–3.65)	0.604	
Na variability						
VIM	1(ref.)	0.68 (0.30–1.57)	0.81 (0.37–1.78)	0.99 (0.46–2.13)	0.907	
SD	1(ref.)	0.89 (0.40–1.99)	0.83 (0.37–1.87)	1.05 (0.47–2.31)	0.929	
CV	1(ref.)	0.96 (0.44–2.13)	0.75 (0.33–1.74)	1.05 (0.47–2.33)	0.970	
Range	1(ref.)	0.56 (0.23–1.39)	1.16 (0.54–2.49)	1.01 (0.45–2.27)	0.567	

This model was adjusted for age, sex, BMI, smoking, hypertension, diabetes, prior MI, cTnI, NTpro-BNP, CRP, eGFR, TG, TC, HDL, MI type, anterior MI, PCI, ACEI or ARB, spironolactone, acute heart failure and mean potassium or sodium.

Table 3S The association between heart failure post-discharge and electrolyte variability assessed by SD, CV and range.

HF (<i>n</i> = 4386)	Crude sHR (95%CI)	<i>P</i> value	Model I sHR (95%CI)	<i>P</i> value	Model II sHR(95%CI)	<i>P</i> value	Model III sHR(95%CI)	<i>P</i> value
Potassium variability								
SD		0.000		0.000		0.045		0.043
Q1								
Q2	1.40 (1.07–1.83)		1.38 (1.05–1.81)		1.16 (0.88–1.54)		1.16 (0.88–1.54)	
Q3	1.62 (1.25–2.11)		1.61 (1.24–2.09)		1.19 (0.90–1.56)		1.19 (0.90–1.56)	
Q4	2.16 (1.68–2.77)		2.12 (1.65–2.72)		1.32 (1.01–1.72)		1.32 (1.01–1.73)	
CV		0.000		0.000		0.044		0.044
Q1								
Q2	1.45 (1.11–1.90)		1.42 (1.09–1.86)		1.22 (0.93–1.61)		1.22 (0.93–1.61)	
Q3	1.59 (1.22–2.07)		1.57 (1.21–2.05)		1.15 (0.87–1.51)		1.15 (0.87–1.51)	
Q4	2.12 (1.65–2.72)		2.12 (1.65–2.72)		1.35 (1.04–1.76)		1.35 (1.04–1.76)	
Range		0.000		0.000		0.005		0.005
Q1								
Q2	1.31 (1.00–1.72)		1.31 (1.00–1.72)		1.13 (0.85–1.49)		1.13 (0.85–1.50)	
Q3	1.64 (1.26–2.15)		1.61 (1.23–2.11)		1.21 (0.92–1.61)		1.22 (0.92–1.62)	
Q4	2.54 (1.98–3.25)		2.50 (1.95–3.21)		1.42 (1.09–1.86)		1.43 (1.10–1.87)	
Sodium variability								
SD		0.000		0.000		0.045		0.048
Q1								
Q2	1.32 (1.01–1.73)		1.28 (0.98–1.67)		1.05 (0.79–1.39)		1.05 (0.79–1.39)	
Q3	1.69 (1.31–2.18)		1.61 (1.24–2.08)		1.24 (0.95–1.63)		1.24 (0.95–1.63)	
Q4	2.10 (1.63–2.69)		1.93 (1.50–2.48)		1.25 (0.96–1.64)		1.25 (0.96–1.63)	
CV		0.000		0.000		0.042		0.047
Q1								
Q2	1.32 (1.01–1.73)		1.29 (0.98–1.69)		1.06 (0.80–1.40)		1.06 (0.80–1.40)	
Q3	1.67 (1.29–2.16)		1.60 (1.24–2.07)		1.24 (0.94–1.62)		1.23 (0.94–1.62)	
Q4	2.14 (1.67–2.75)		1.98 (1.54–2.54)		1.27 (0.97–1.65)		1.26 (0.97–1.64)	
Range		0.000		0.000		0.009		0.009
Q1								
Q2	1.25 (0.95–1.64)		1.24 (0.94–1.63)		1.06 (0.80–1.41)		1.06 (0.80–1.41)	
Q3	1.66 (1.28–2.16)		1.60 (1.23–2.08)		1.27 (0.97–1.67)		1.27 (0.97–1.67)	
Q4	2.43 (1.90–3.11)		2.25 (1.76–2.88)		1.36 (1.04–1.77)		1.36 (1.04–1.77)	

CI, confidence interval; HR, hazards ratio; Model I: adjusted for age and sex; Model II: adjusted for model 1 plus BMI, smoking, hypertension, diabetes, prior MI, cTnI, NTpro-BNP, CRP, eGFR, TG, TC, HDL, MI type, anterior MI, PCI, ACEI or ARB, spironolactone and acute heart failure; Model III: adjusted for model 1 plus mean potassium or sodium level.

Table 4S The association between heart failure post-discharge and potassium variability estimated with Fine-Gray model.

K variability	Q1	Q2	Q3	Q4	P trend
VIM	1(ref.)	1.20 (0.90–1.58)	1.25 (0.95–1.64)	1.28 (0.98–1.67)	0.077
SD	1(ref.)	1.14 (0.86–1.51)	1.17 (0.88–1.54)	1.28 (0.98–1.66)	0.072
CV	1(ref.)	1.19 (0.90–1.57)	1.13 (0.85–1.49)	1.30 (1.00–1.69)	0.074
Range	1(ref.)	1.11 (0.83–1.47)	1.21 (0.91–1.61)	1.39 (1.06–1.81)	0.009

This model was adjusted for age, sex, BMI, smoking, hypertension, diabetes, prior MI, cTnI, NTpro-BNP, CRP, eGFR, TG, TC, HDL, MI type, anterior MI, PCI, ACEI or ARB, spironolactone, acute heart failure and mean potassium.

Table 5S the association between total mortality and potassium variability in patients with potassium 3.0–5.5 mmol/L and sodium 130–150 mmol/L during hospitalization.

K variability	Q1	Q2	Q3	Q4	P trend
Crude model					
VIM	1(ref.)	1.91 (1.05–3.49)	2.22 (1.23–4.02)	2.90 (1.63–5.19)	0.000
SD	1(ref.)	1.56 (0.83–2.92)	2.24 (1.24–4.04)	3.44 (1.95–6.07)	0.000
CV	1(ref.)	1.67 (0.90–3.10)	2.29 (1.27–4.13)	3.16 (1.78–5.60)	0.000
Range	1(ref.)	1.63 (0.90–2.95)	1.59 (0.86–2.96)	3.80 (2.19–6.58)	0.000
Age- and sex-adjusted model					
VIM	1(ref.)	1.82 (1.00–3.33)	2.18 (1.21–3.94)	3.06 (1.71–5.48)	0.000
SD	1(ref.)	1.50 (0.80–2.81)	2.16 (1.19–3.90)	3.39 (1.92–6.00)	0.000
CV	1(ref.)	1.58 (0.85–2.94)	2.23 (1.24–4.02)	3.25 (1.83–5.79)	0.000
Range	1(ref.)	1.60 (0.88–2.89)	1.53 (0.82–2.85)	3.74 (2.15–6.48)	0.000
Fully adjusted model					
VIM	1(ref.)	1.56 (0.84–2.87)	1.60 (0.87–2.92)	2.13 (1.17–3.88)	0.017
SD	1(ref.)	1.24 (0.65–2.35)	1.50 (0.82–2.76)	2.13 (1.17–3.86)	0.006
CV	1(ref.)	1.38 (0.74–2.59)	1.60 (0.88–2.92)	2.16 (1.19–3.91)	0.008
Range	1(ref.)	1.30 (0.71–2.40)	1.17 (0.62–2.21)	2.17 (1.21–3.88)	0.008

The final model was adjusted for age, sex, BMI, smoking, hypertension, diabetes, prior MI, cTnI, NTpro-BNP, CRP, eGFR, TG, TC, HDL, MI type, anterior MI, PCI, ACEI or ARB, spironolactone, acute heart failure and mean potassium.