Serum uric acid as a clinically useful nutritional marker and predictor of outcome in maintenance hemodialysis patients

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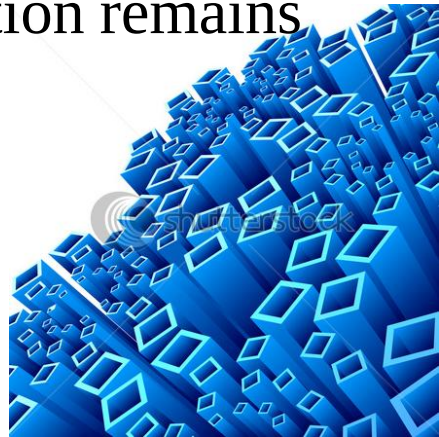
Background

High circulating concentrations of UA have been shown to be associated with an increased risk of hypertension, prehypertension, peripheral arterial disease, diabetes mellitus, chronic kidney disease, and cardiovascular disease in the general population.

Feig DI, Kang DH, Johnson RJ. Uric acid and cardiovascular risk. N Engl J Med. 2008; 359 : 1811-1821.

Gagliardi AC, Miname MH, Santos RD. Uric acid: a marker of increased cardiovascular risk. Atherosclerosis. 2009; 202: 11-17.

- Its importance as a marker for hemodialysis population remains unclear.



Background

J-Shaped Mortality Relationship for Uric Acid in CKD

Am J Kidney Dis 48:761-771.

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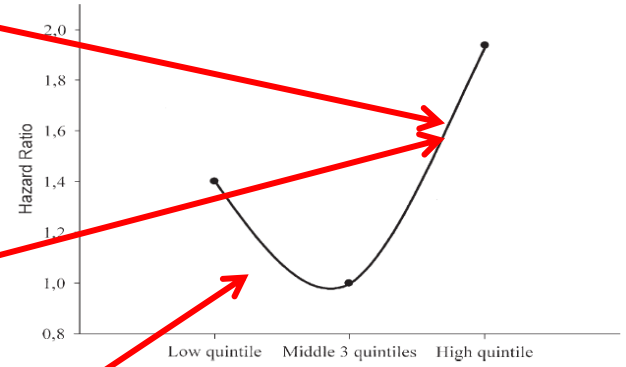


Nephrol Dial Transplant (2004) 19: 457–462
DOI: 10.1093/ndt/gfg563

Nephrology Dialysis Transplantation

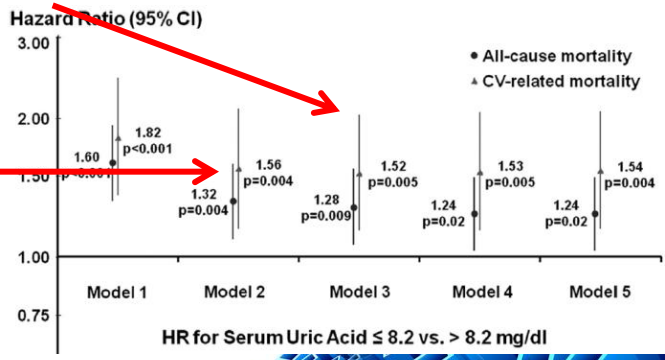
Preliminary Communication

Serum uric acid levels show a 'J-shaped' association with all-cause mortality in haemodialysis patients

U.A.I

Uric Acid Levels and All-Cause and Cardiovascular Mortality in the Hemodialysis Population

Clin J Am Soc Nephrol 6: 2470–2477, October, 2011



American Journal of Nephrology

Am J Nephrol 2009;29:79–85
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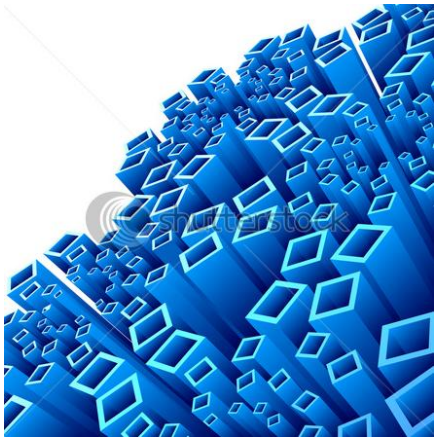
Low Serum Uric Acid Level Is a Risk Factor for Death in Incident Hemodialysis Patients

Study hypothesis & aims

- In order to explain an inverse association of UA levels with survival, we hypothesized that higher UA among HD patients is an indicator of better nutritional status.

- We aimed to investigate the associations of SUA levels with clinical and laboratory surrogates of nutrition and inflammation, muscle function, health-related quality of life, and all-cause and cardiovascular morbidity and mortality in maintenance HD (MHD) patients.



Outcomes & Measurements

➢ **Measurements at baseline :**

✓ Serum uric acid (SUA)

✓ Dietary energy and protein intake

✓ Biochemical markers of nutrition and inflammation

✓ Handgrip strength

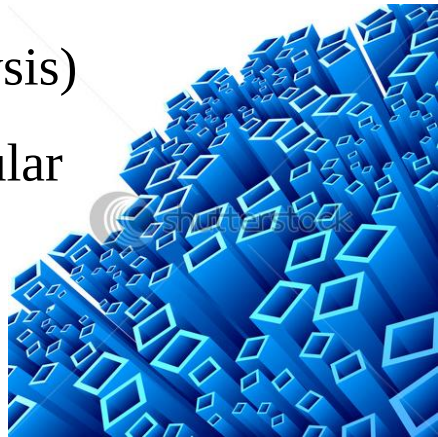
✓ Nutritional scores (MIS & GNRI)

✓ Short Form 36 quality of life (QoL) scoring system

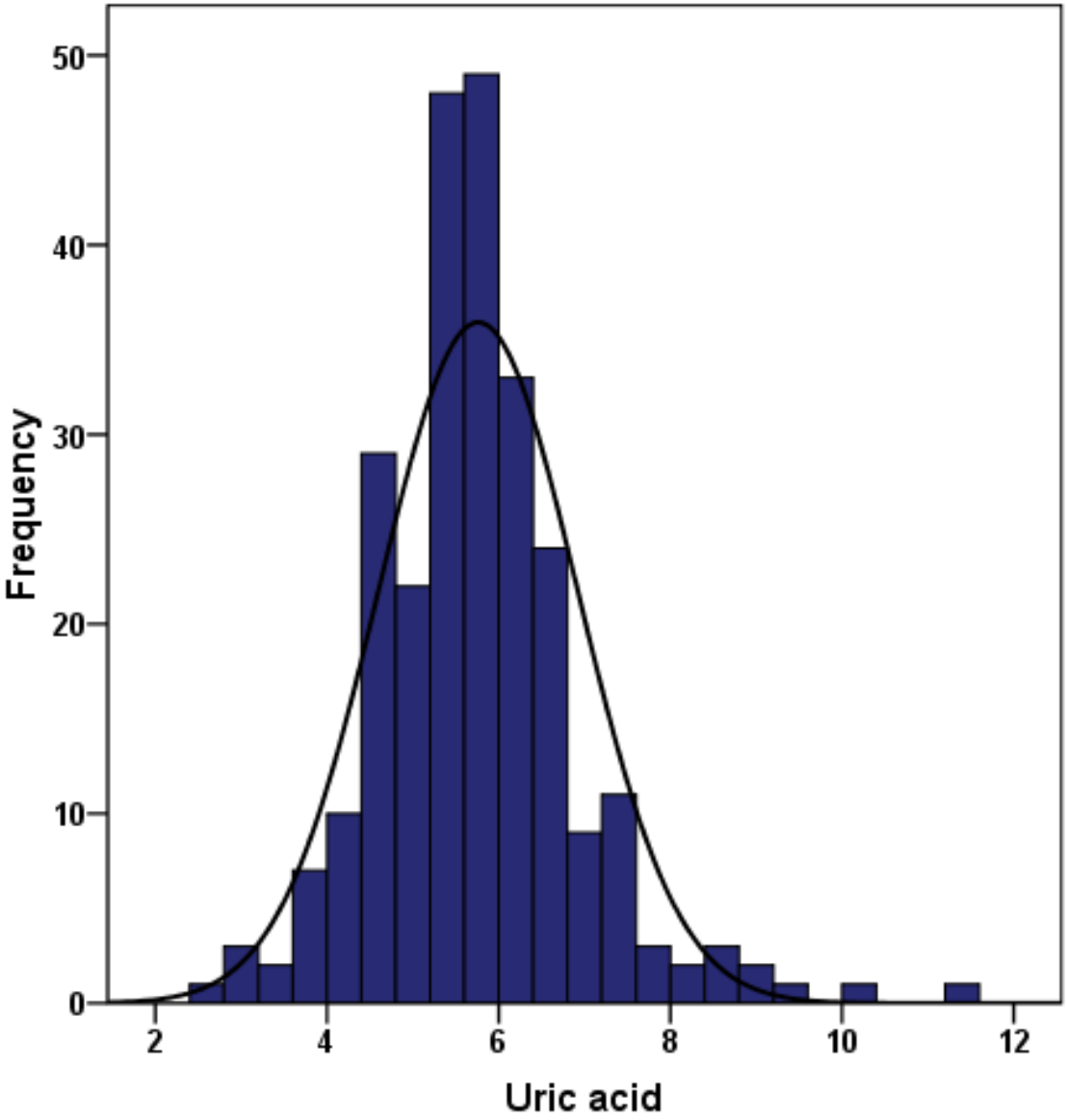
✓ Body composition (anthropometry and bioimpedance analysis)

➢ **Outcomes:** all-cause morbidity and mortality; cardio-vascular morbidity and mortality

➢ **Study period:** 17 months (interquartile range 9.0-24.0 months).



Histogram showing the distribution of serum uric acid concentration in the study cohort (n=261)



Mean±SD:
5.76±1.2 mg/dl

Median (IQR):
5.7 (5.1-6.3) mg/dl

Raw and adjusted correlation coefficients of uric acid with the main nutritional and inflammatory markers in the study population (n=261)

	Raw r	P	Adjusted* r	P
nPNA (g/kg/d)	0.16	0.06	0.16	0.08
Albumin (g/dL)	0.29	<0.001	0.21	0.01
Creat (mg/dL)	0.47	<0.001	0.43	<0.001
Trf (mg/dL)	0.19	0.04	0.04	0.67
IL-6 (pg/ml)	-0.13	0.04	-0.15	0.03
BMI (kg/m^2)	0.26	<0.001	0.29	<0.001
Waist–hip ratio	0.16	0.01	0.18	0.009
MAMC (cm)	0.23	<0.001	0.14	0.05
BIA FM (kg)	0.29	<0.001	0.32	<0.001
BIA LBM (kg)	0.20	0.001	0.15	0.03

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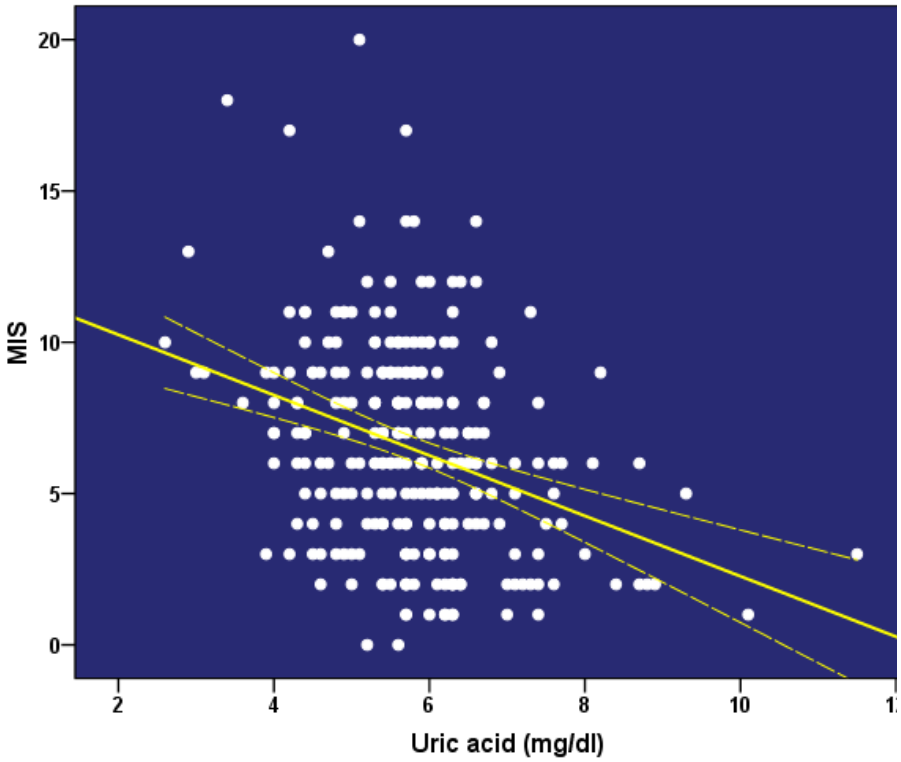
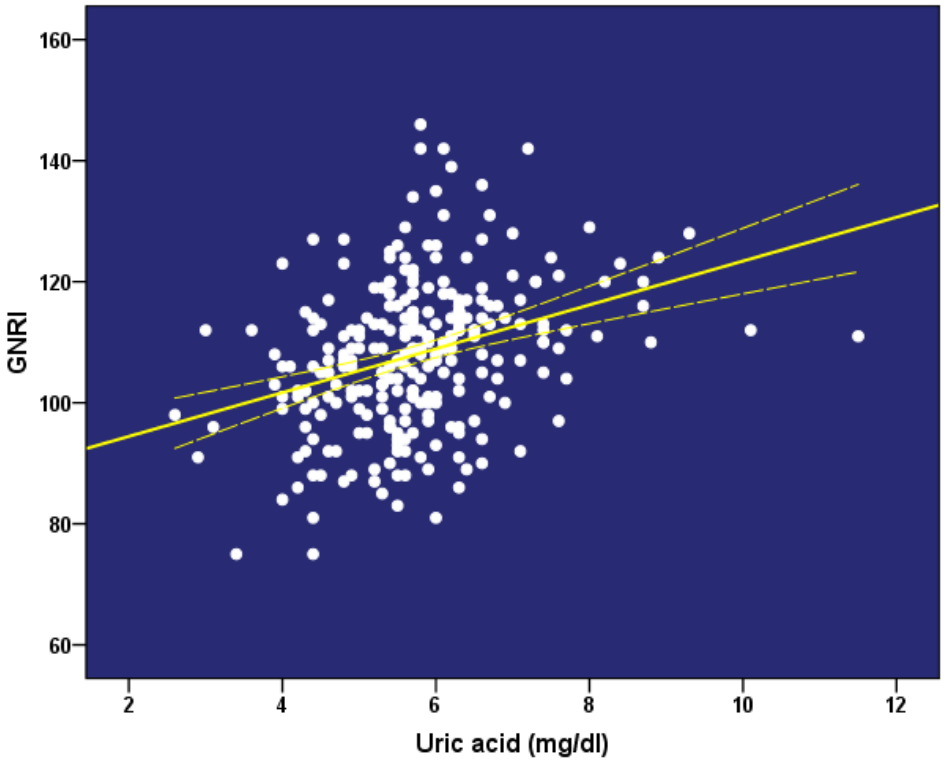
Bivariate correlations between levels of serum uric acid and nutritional scores among 261 MHD patients



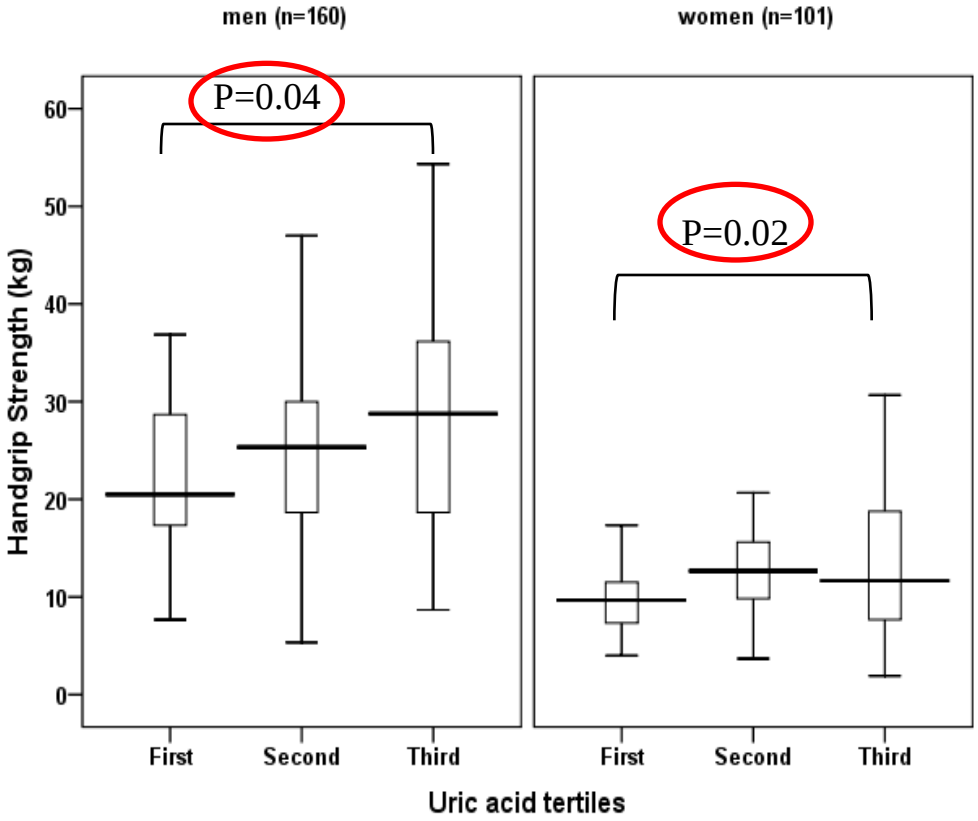


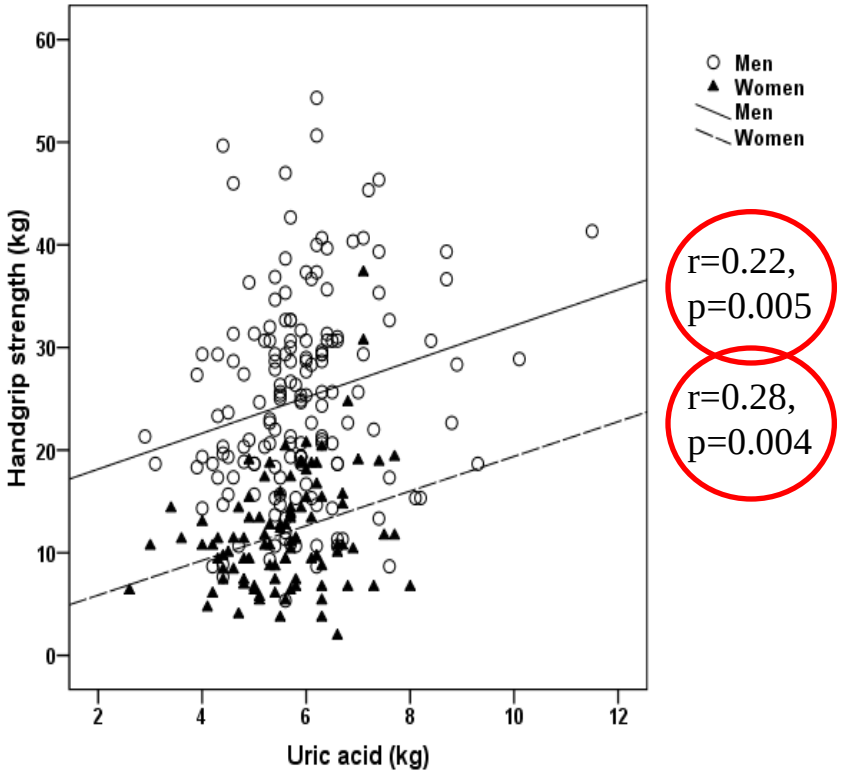
R=-0.33, p<0.001

R=0.34, P<0.001

Solid line represents regression line and dashed lines above and below solid line – 95% confidence interval

Comparison of handgrip strength in men (n = 160) and women (n = 101)

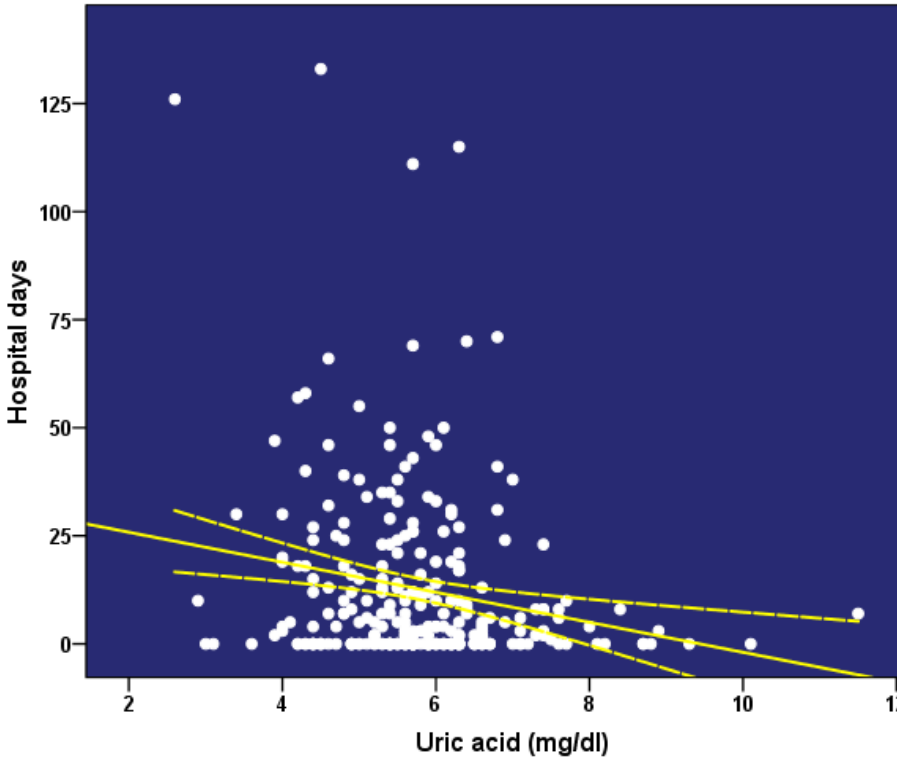


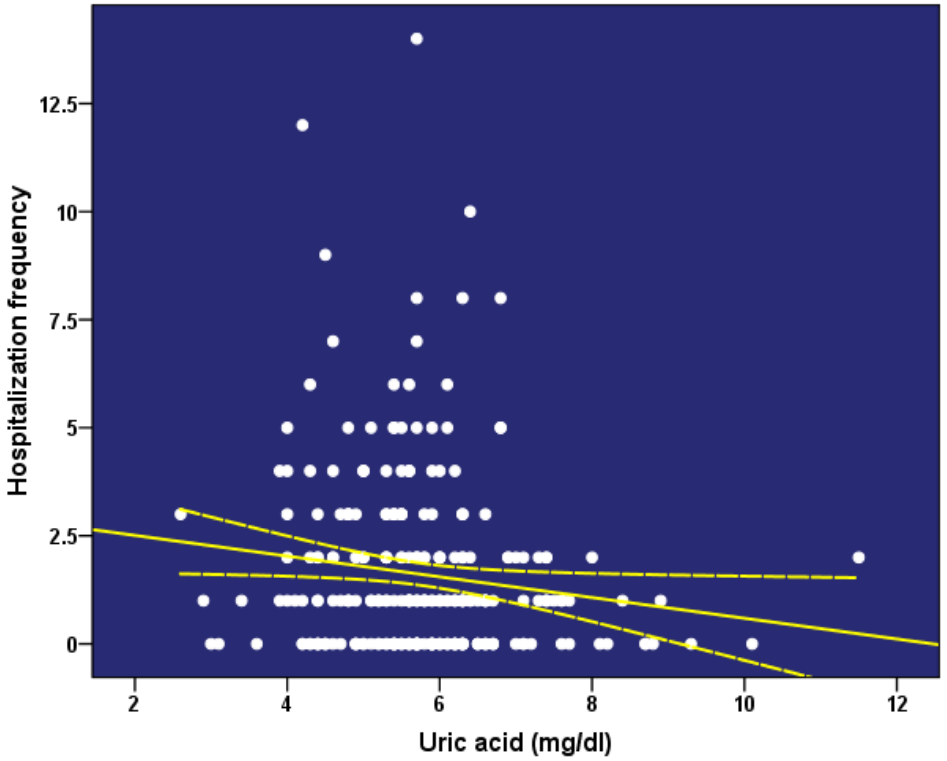


Baseline SF36 health-related quality of life scores across tertiles of uric acid in 252 MHD patients

Variable	Tertile 1 (n=92)	Tertile 2 (n=79)	Tertile 3 (n=81)	P for trend
SF-36 Overall				
SF-36 Total score	40.5 (20.3-50.6)	41.9 (33.1-58.0)	45.7 (34.8-60.1)	0.04
SF-36 Dimensions				
SF-36 Mental Health	41.7 (33.3-52.5)	44.8 (34.5-57.2)	46.5 (37.9-58.1)	0.15
SF-36 Phys. Health	34.3 (24.6-44.7)	35.3 (27.5-50.5)	42.3 (28.0-54.3)	0.06
SF-36 Scales				
Body Pain	50.0 (25.0-62.5)	50.0 (25.0-75.0)	50.0 (25.0-62.5)	0.62
General Health	27.5 (15.0-45.0)	35.0 (15.0-50.0)	30.0 (15.0-45.0)	0.57
Mental Health	60.0 (45.0-65.0)	60.0 (45.0-65.0)	60.0 (50.0-65.0)	0.75
Physical Function	20.0 (5.0-45.0)	20.0 (5.0-40.0)	40.0 (17.5-62.5)	0.003
Role–Emotional	50.0 (25.0-62.5)	50.0 (25.0-75.0)	50.0 (41.7-75.0)	0.09
Role–Physical	31.3 (3.1-50.0)	37.5 (25.0-50.0)	50.0 (25.0-71.9)	0.006
Social functioning	50.0 (25.0-50.0)	50.0 (37.5-62.5)	50.0 (37.5-68.8)	0.09
Vitality	37.5 (25.0-56.3)	43.8 (31.3-56.3)	43.8 (31.3-56.3)	0.44

Bivariate correlations between levels of serum uric acid and hospitalization days, and hospitalization frequency





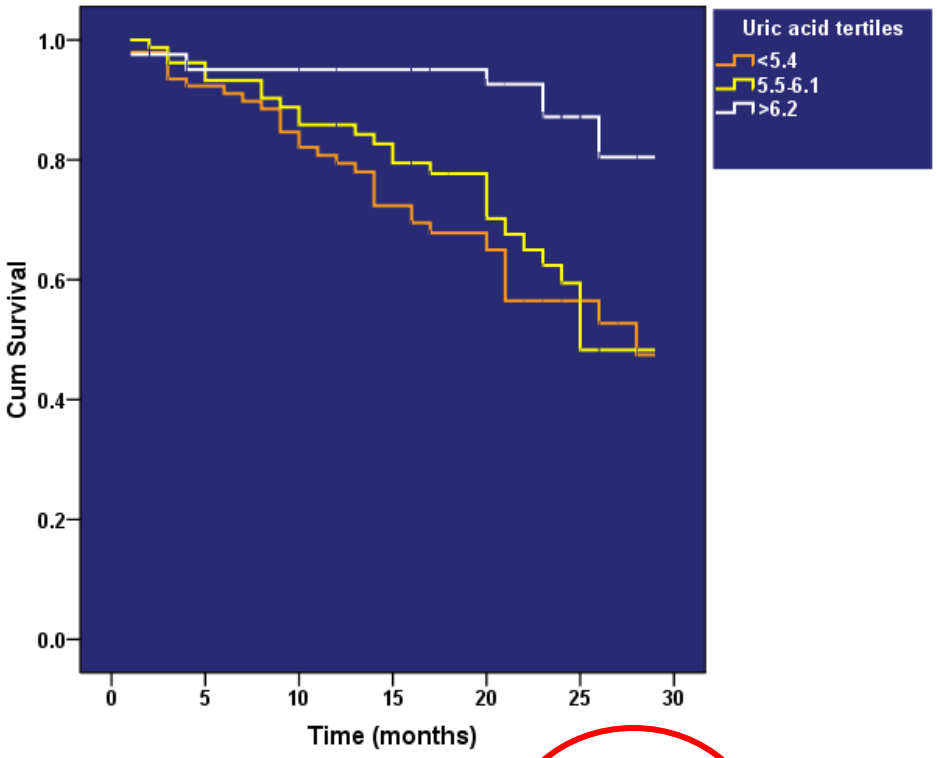
R=-0.19, p=0.002

R=-0.13, P=0.03

Solid line represents regression line and dashed lines above and below solid line – 95% confidence interval

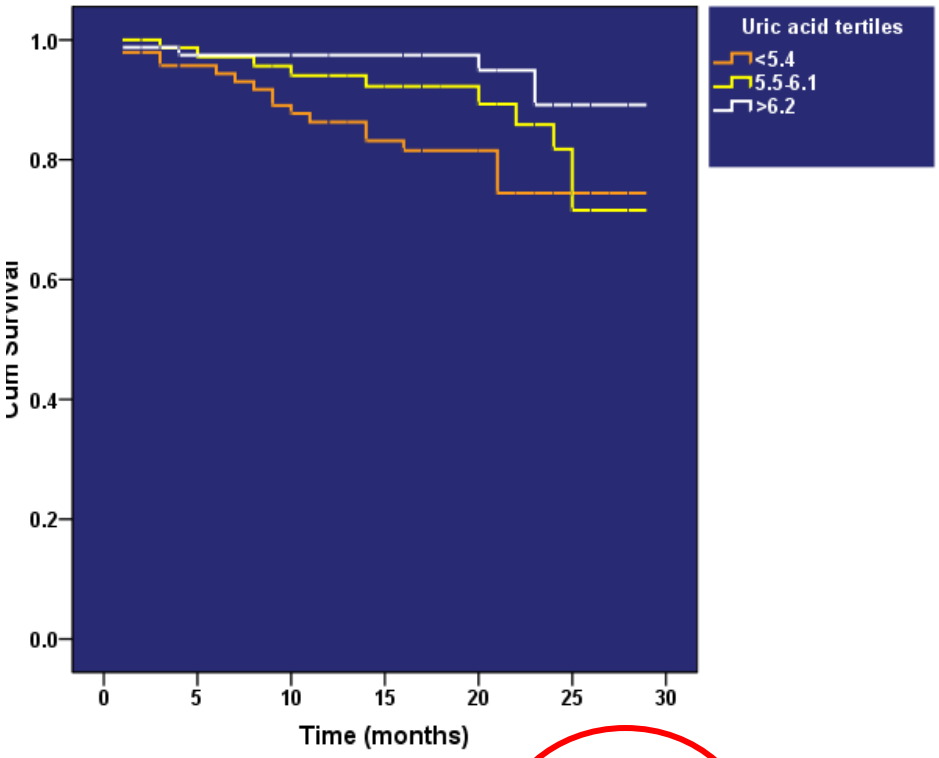
Kaplan-Meier survival analysis for tertiles of serum uric acid in 261 MHD patients followed for up to 2 years: (A) all-cause mortality, and (B) cardiovascular mortality.

a



Log rank χ^2=16.1, p<0.001

b



Log rank χ^2=6.89, p=0.030

Crude and adjusted all-cause and CVD-related mortality according to uric acid levels in 261 MHD patients

	HR	95% CI	p
All-cause mortality			
1. Crude	0.55	(0.43-0.72)	<0.001
2. 1+age, gender, RRF and vintage	0.56	(0.43-0.74)	<0.001
3. 2+DM, CMI, WHR, Smoking and SBP	0.59	(0.44-0.80)	0.001
4. 3+MIS and IL-6	0.59	(0.41-0.85)	0.005
Cardio-vascular mortality			
1. Crude	0.55	(0.37-0.80)	0.002
2. 1+age, gender, RRF and vintage	0.55	(0.38-0.80)	0.002
3. 2+DM, CMI, WHR, Smoking and SBP	0.61	(0.41-0.91)	0.01
4. 3+MIS and IL-6	0.53	(0.33-0.86)	0.01

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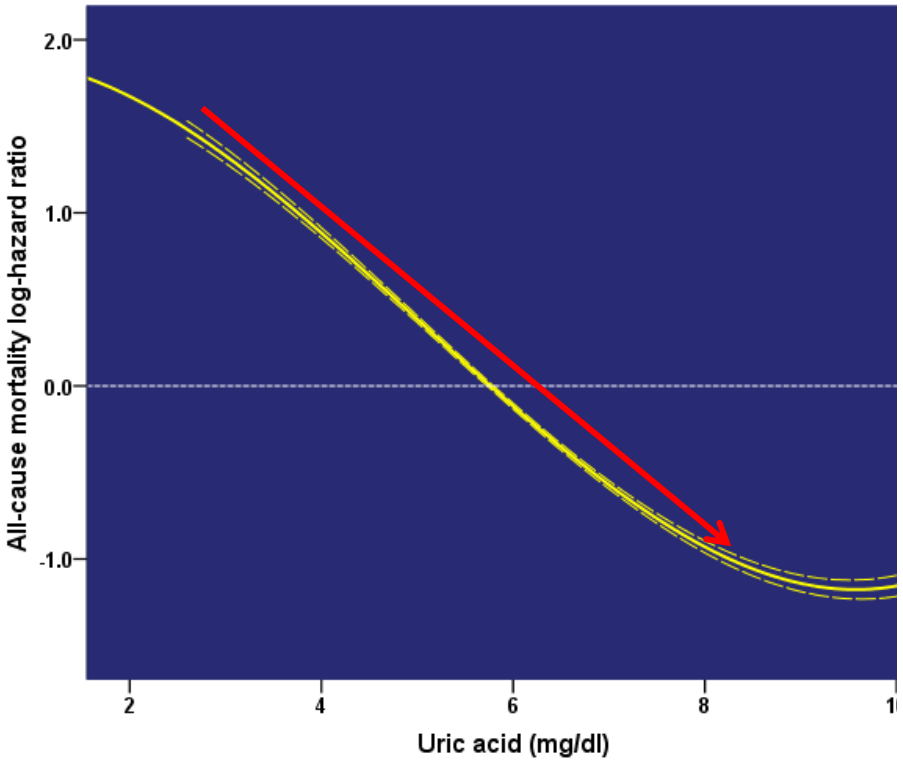
4. 3+MIS and IL-6	0.53	(0.33-0.86)	0.01

Crude and adjusted all-cause and CVD-related morbidity according to uric acid levels in 261 MHD patients

	HR	95% CI	p
All-cause hospitalization			
1. Crude	0.79	(0.68-0.91)	0.002
2. 1+age, gender, RRF and vintage	0.80	(0.68-0.93)	0.004
3. 2+DM, CMI, WHR, Smoking and SBP	0.84	(0.72-0.99)	0.04
4. 3+MIS and IL-6	0.94	(0.78-1.14)	0.54
Cardio-vascular hospitalization			
1. Crude	0.60	(0.44-0.82)	0.001
2. 1+age, gender, RRF and vintage	0.59	(0.43-0.80)	0.001
3. 2+DM, CMI, WHR, Smoking and SBP	0.82	(0.56-1.20)	0.31
4. 3+MIS and IL-6	0.81	(0.56-1.19)	0.28

Multivariable-adjusted spline curves of all-cause (a) and CVD (b) mortality, associated with baseline levels of serum uric acid in Cox models. among 261 MHD patients

a



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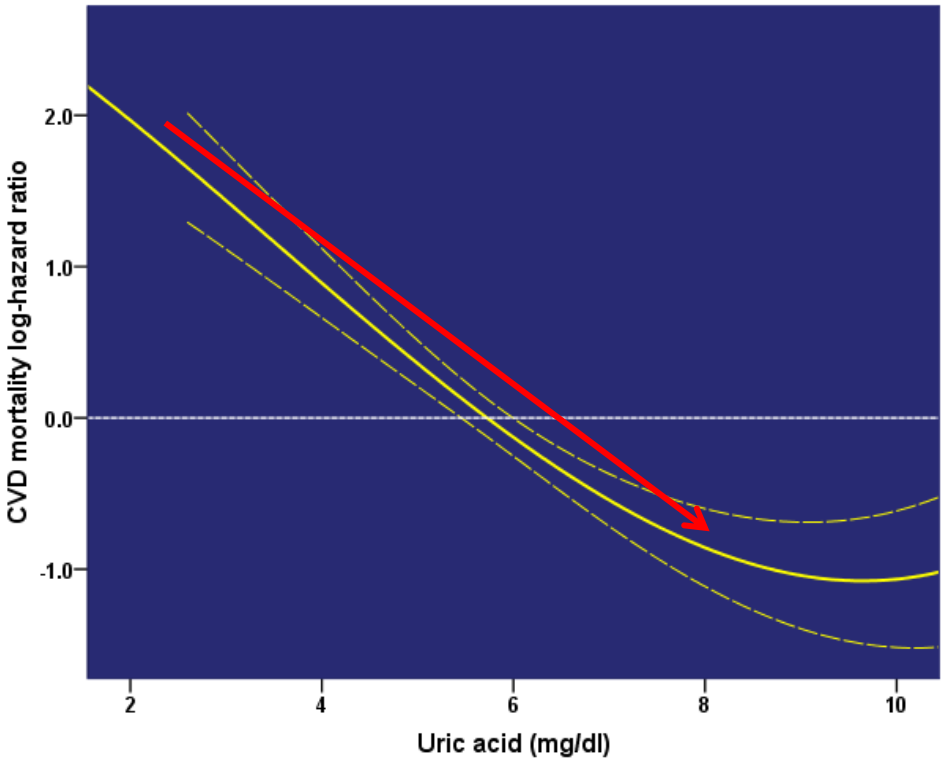
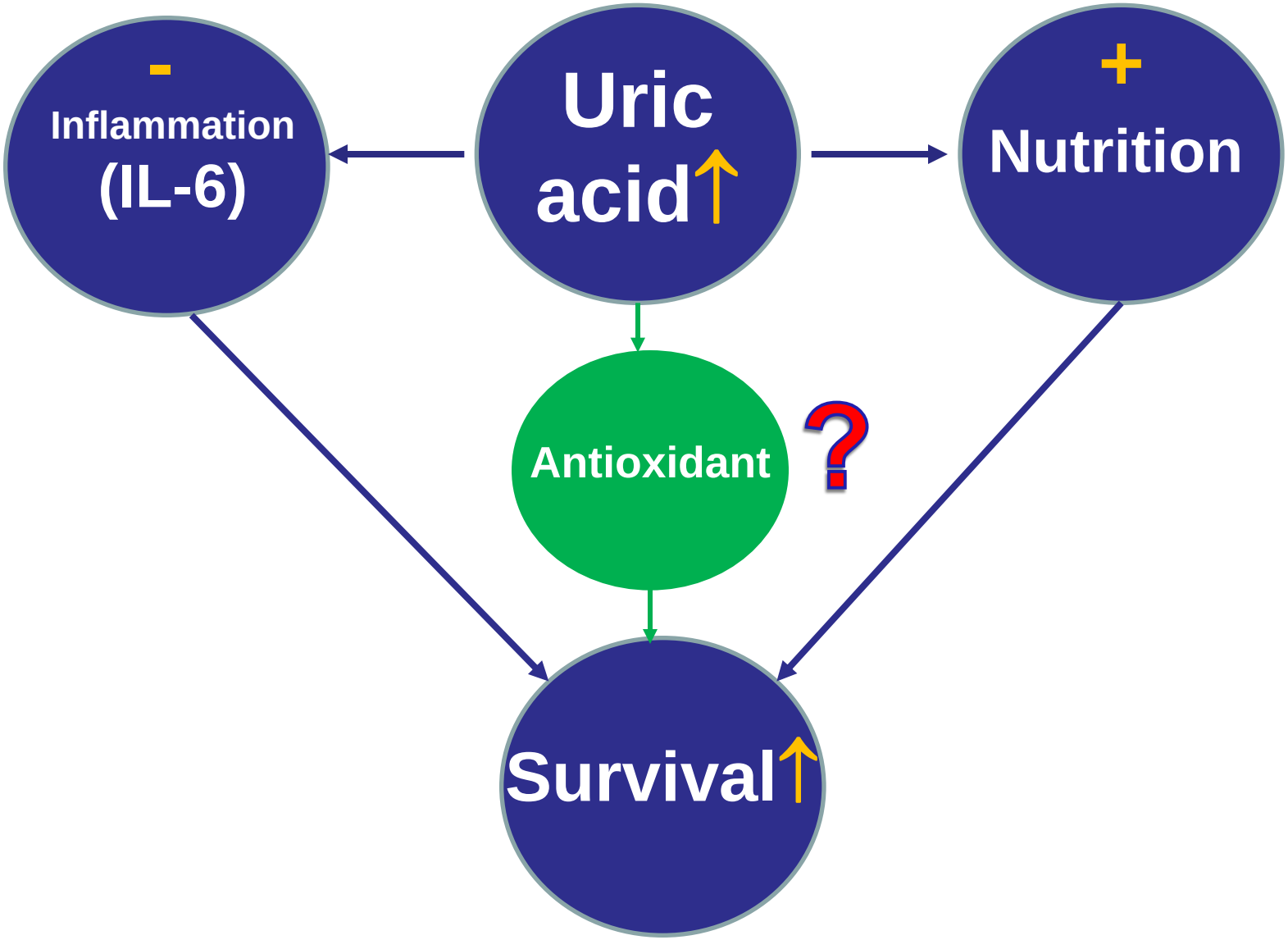


Solid line represents regression line and dashed lines above and below solid line – 95% confidence interval

Uric acid in hemodialysis population



Conclusions

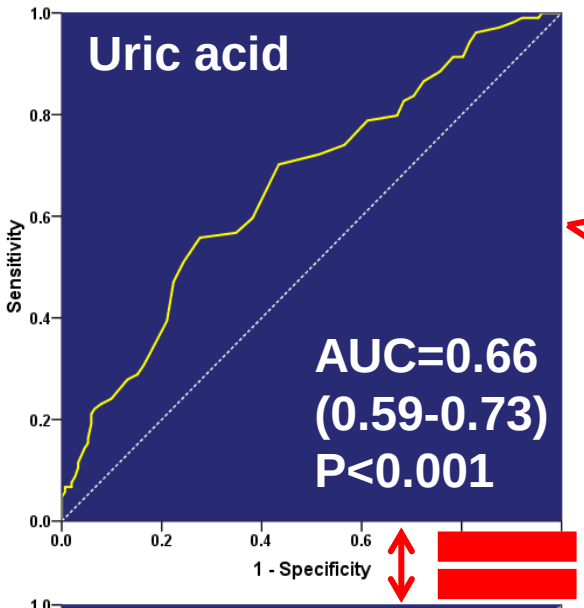
- SUA is a clinically useful marker of nutritional status, associated with most surrogates of body composition, muscle function, inflammation, and health-related quality of life in MHD patients.

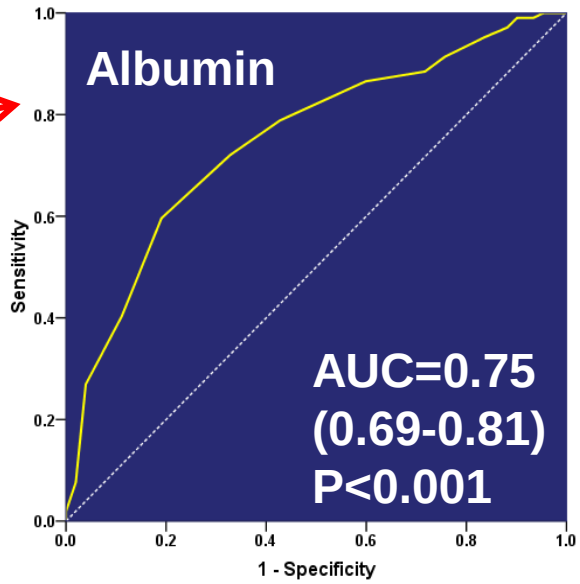
- SUA is a good marker of upcoming hospitalizations (both all-cause and CVD), as well as an independent predictor of all-cause and cardiovascular death risk.

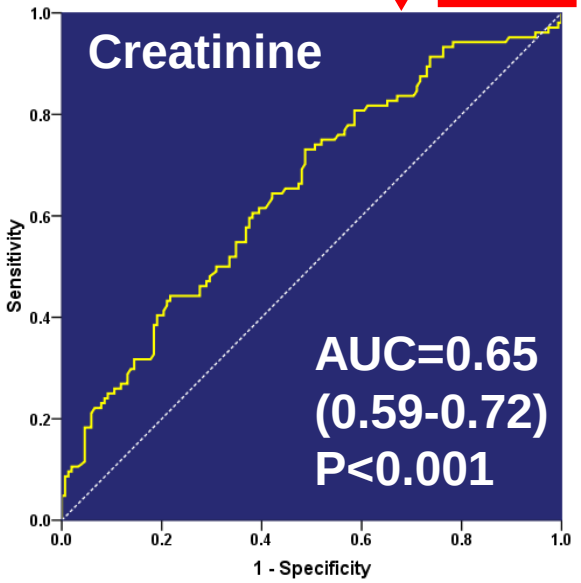
- SUA is a simple, easily performed and inexpensive laboratory test that may be used in conjunction with serum albumin in a quick identification of MHD patients at nutritional risk and those needing early nutritional interventions.

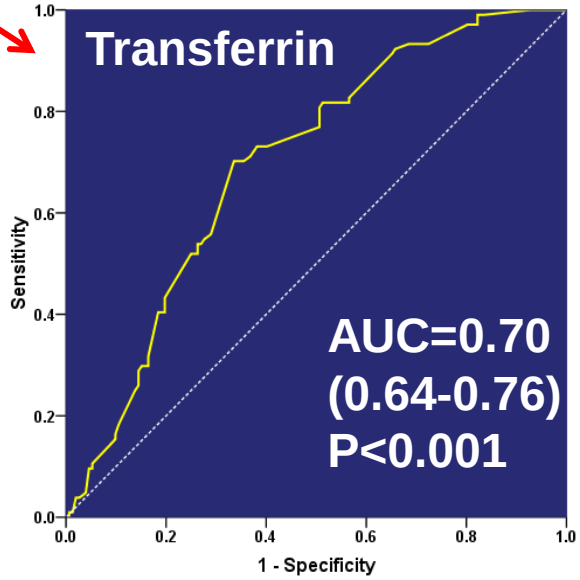
Thank You

Comparing the AUC of uric acid with other nutritional biomarkers in predicting nutritional risk (MIS>5) in 261 hemodialysis patients

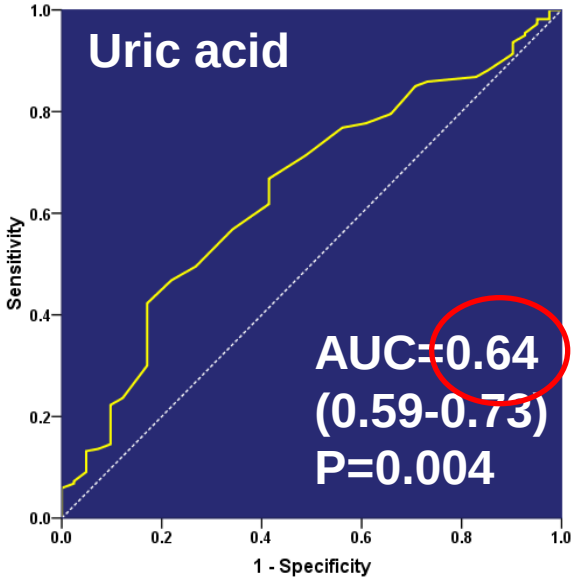


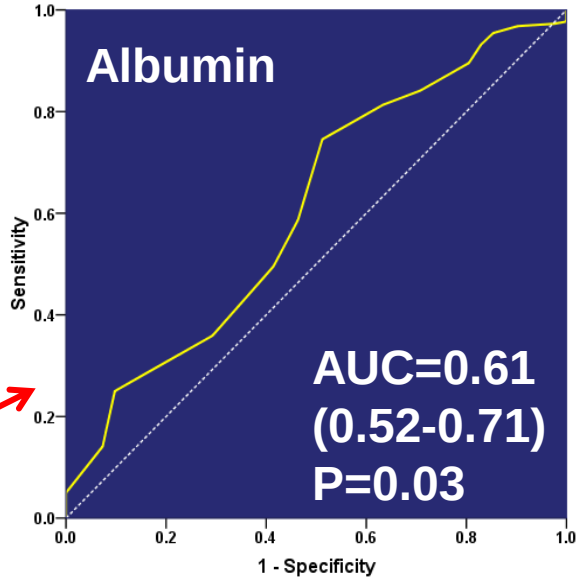


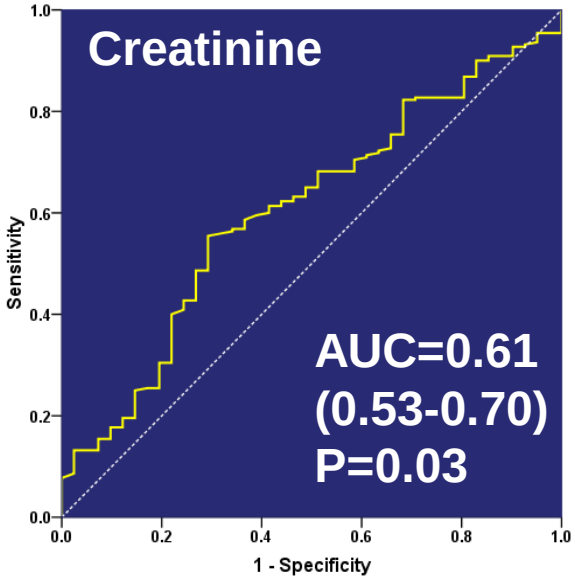


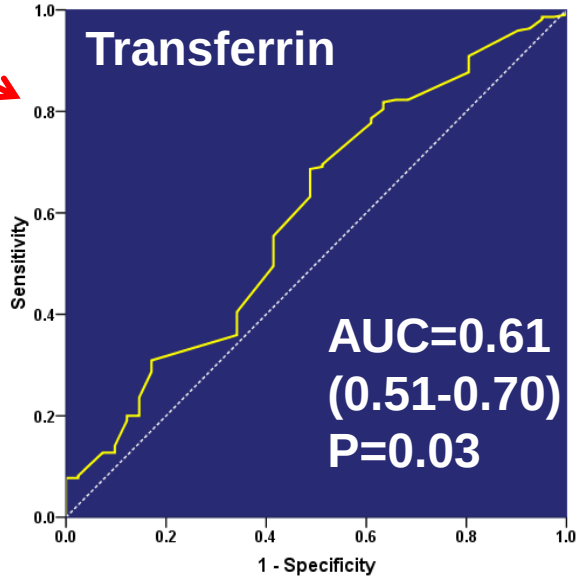
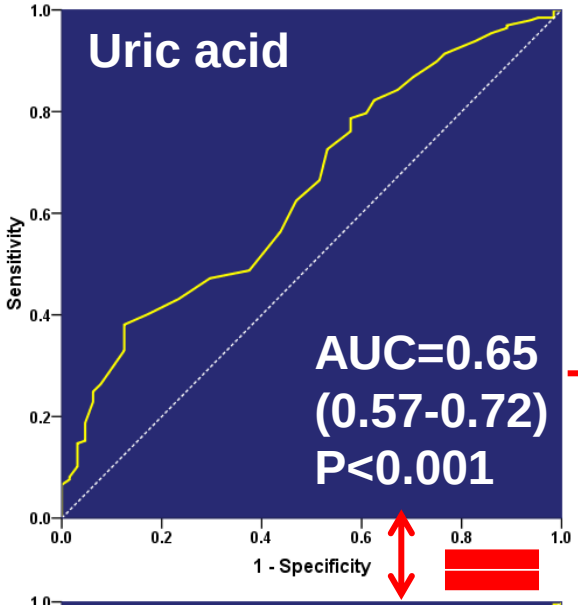
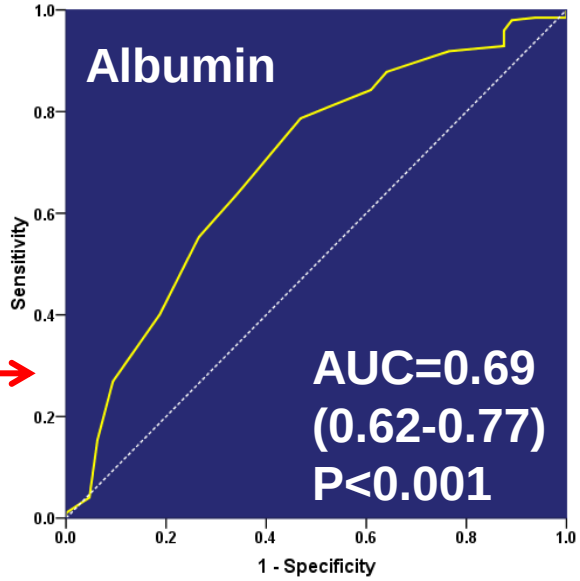
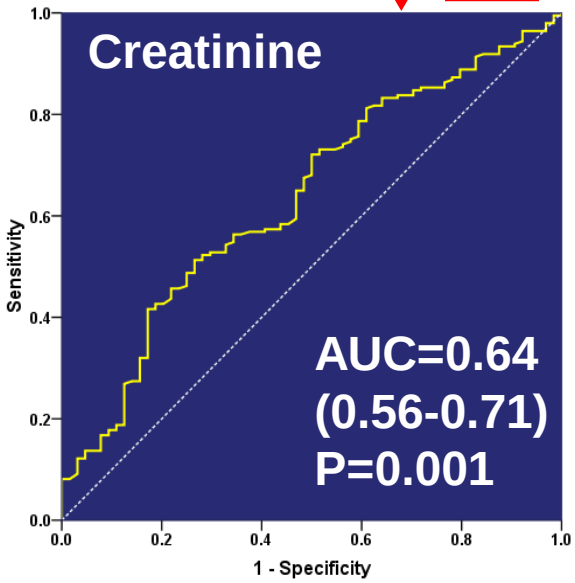
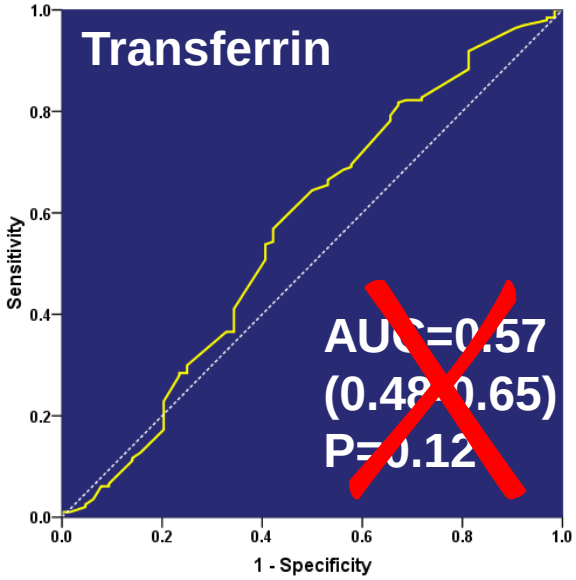


Comparing the AUC of uric acid with other nutritional biomarkers in predicting cardiovascular hospitalization risk in 261 hemodialysis patients









Comparing the AUC of uric acid with other nutritional biomarkers in predicting all-cause mortality risk in 261 hemodialysis patients