

Nephrology and Transplantation Department
Labbafinejad Medical Center



Shahid Beheshti University
of Medical Sciences



Social Security Organization
of Islamic Republic of Iran



How Much Dialysis Do Patients Need?

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1400.07.09

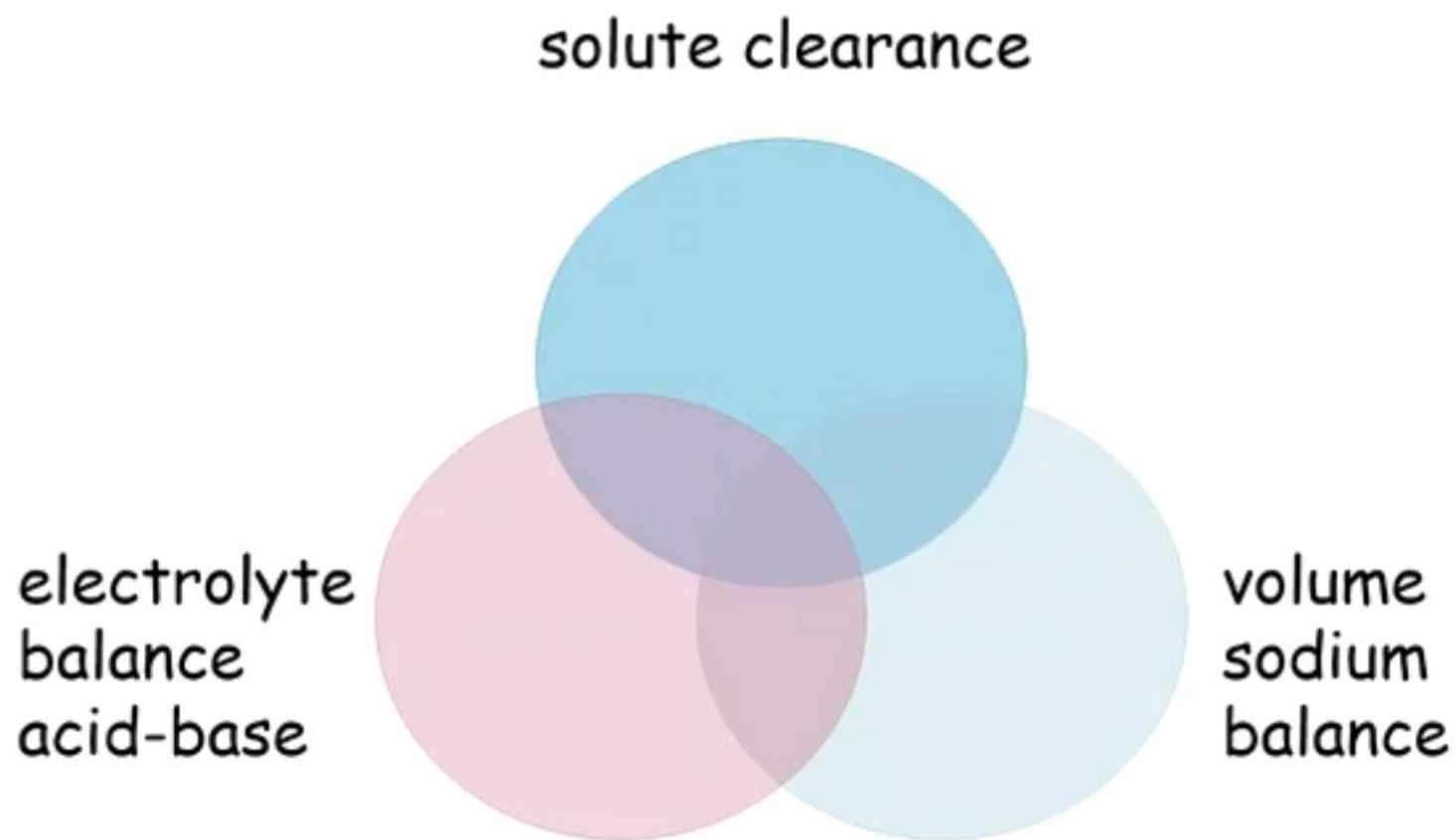
How much dialysis do patients need ?



Andrew Davenport
UCL Department of Renal Medicine
Royal Free Hospital
University College London



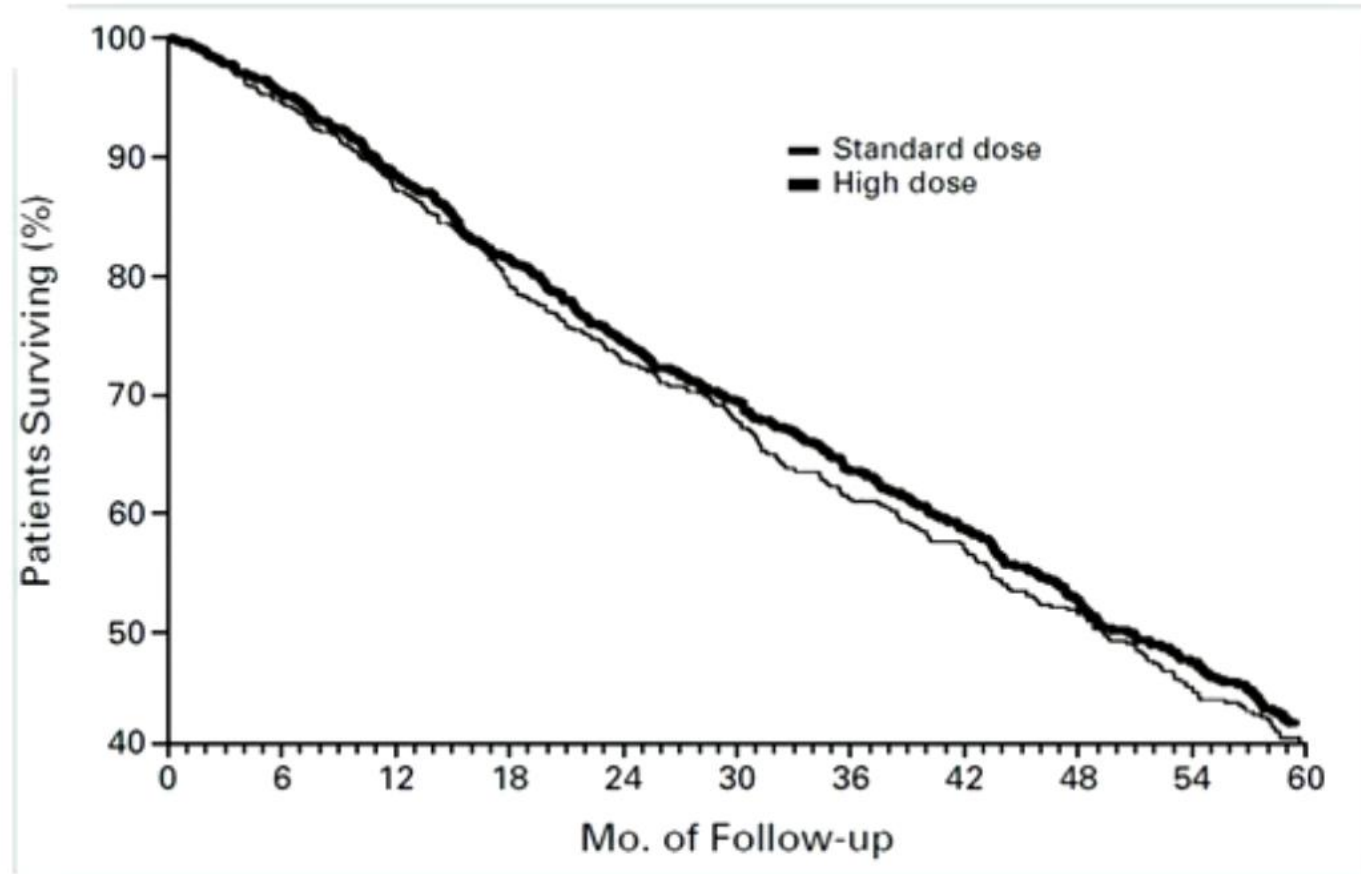
Dialysis prescription



No benefit from greater dialyser Kt/Vurea clearance



HEMO study



How did we get here ?



Where did Kt/Vurea come from ?



Group	Session duration	Mid week BUN	Time averaged BUN
1	4:29	71.2	51.3
2	4:31	104.9	87.7
3	3:19	70.1	54.1
4	3:14	109.1	89.6

151 patients aged 18-70 yrs (mean age 49 yr)

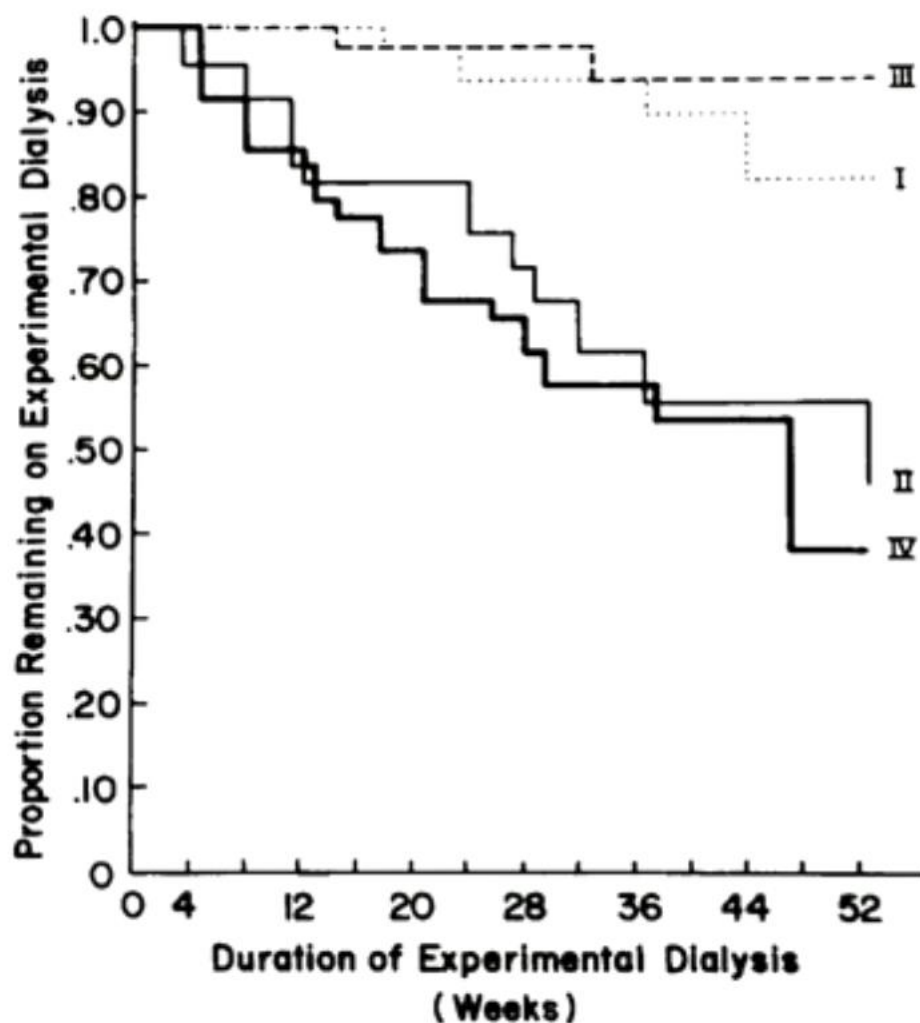
Residual renal function < 3 ml/min

No diabetes, cancer, liver or pulmonary disease

Low flux cellulosic dialyzers



Where did Kt/V come from ?



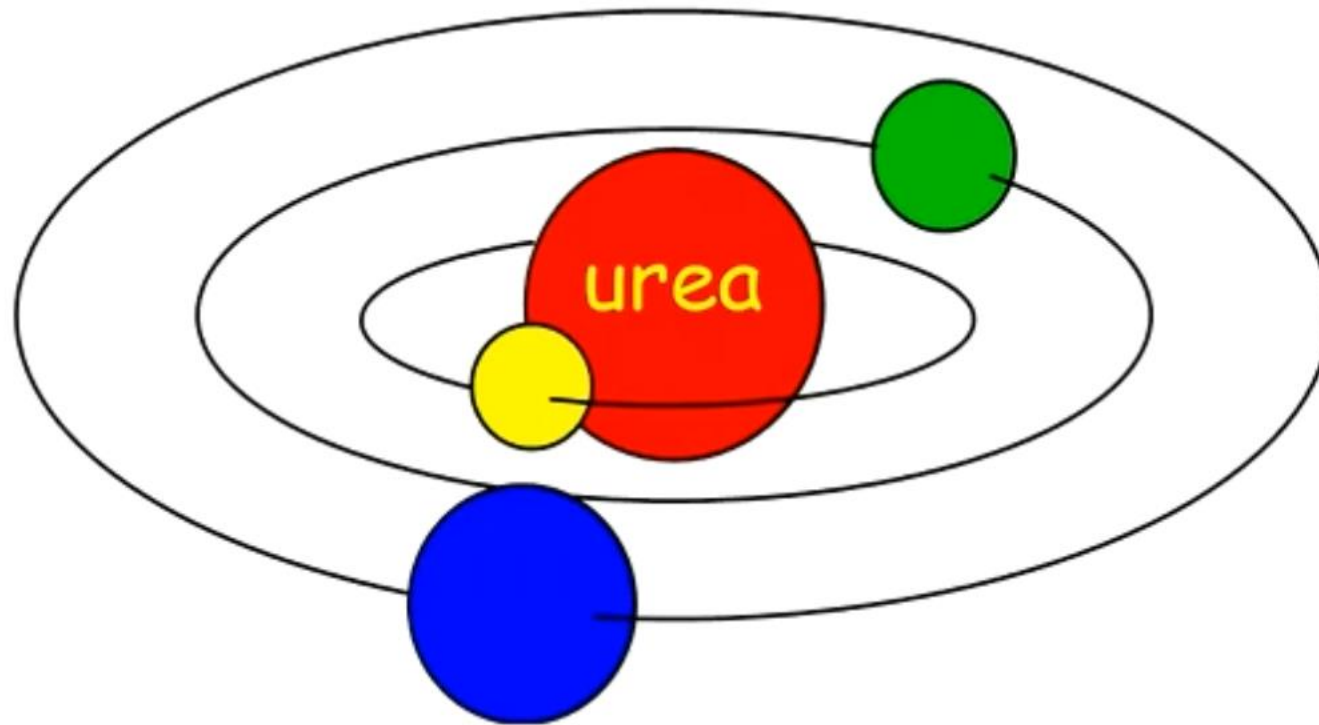
lower time averaged urea

No difference
in mortality

higher time averaged urea



Urea - o - centric world



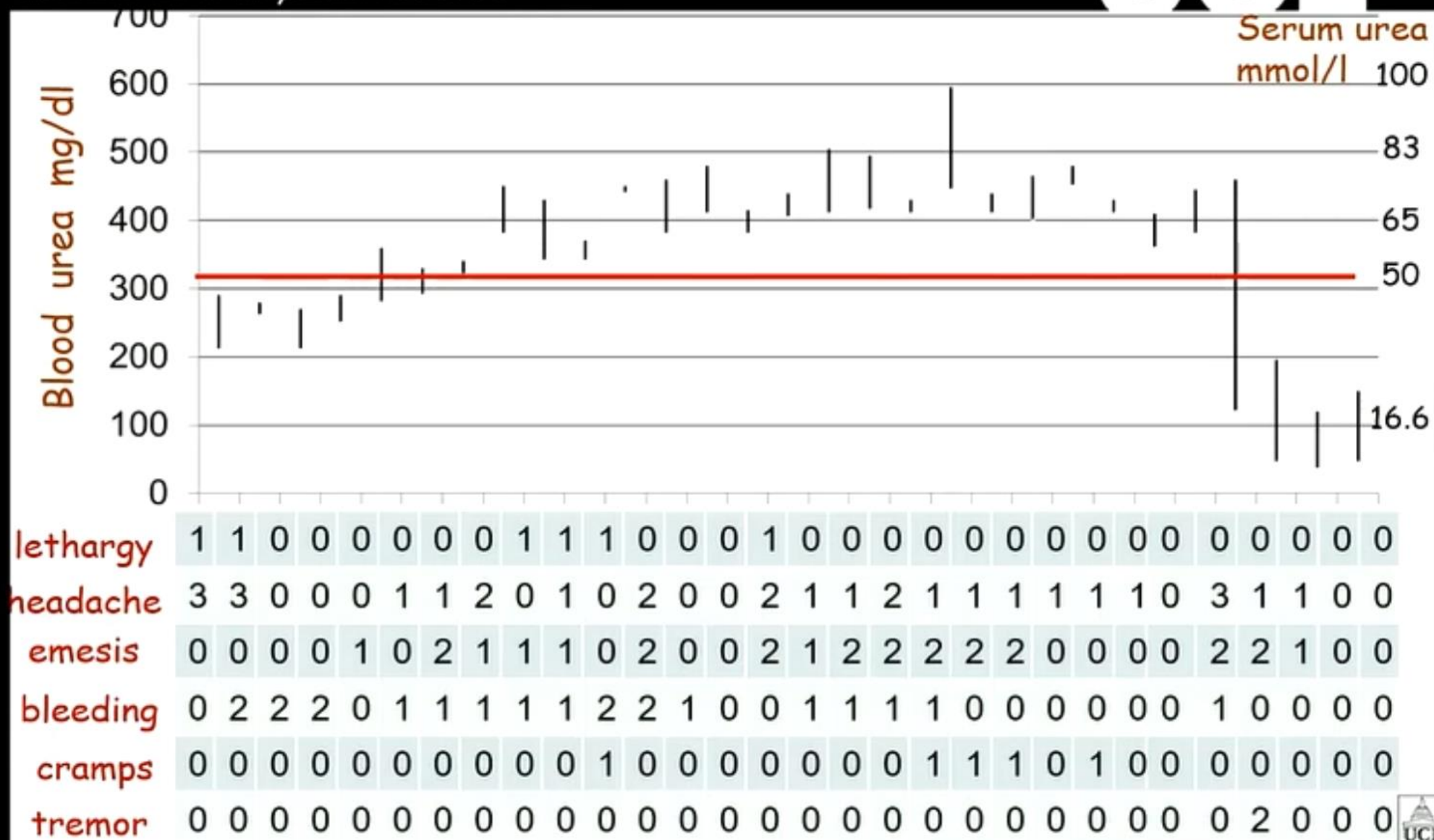
original K_t/V_{urea} target > 1.0



How toxic is urea ?

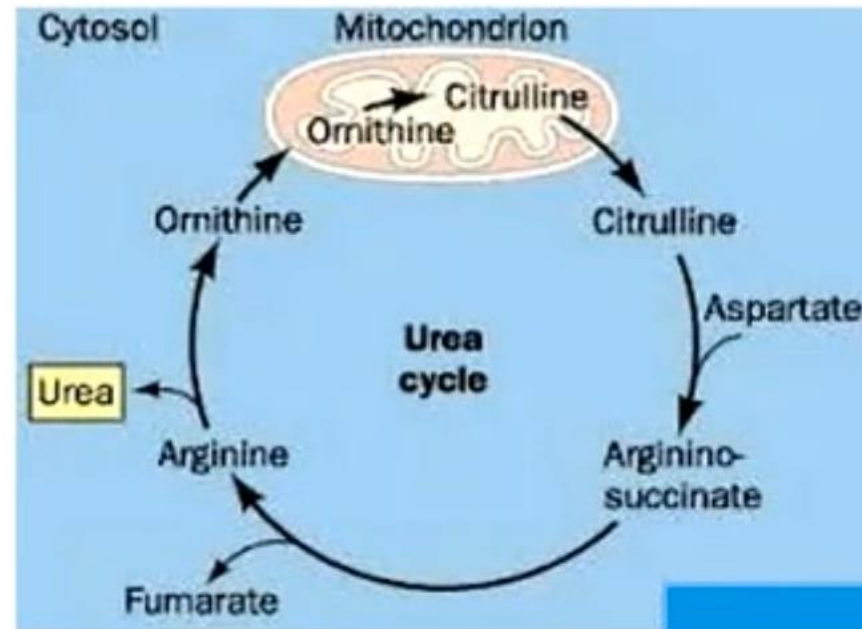
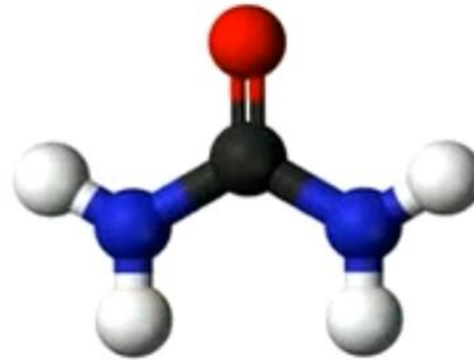


Johnson et al MayoClinProc 1972



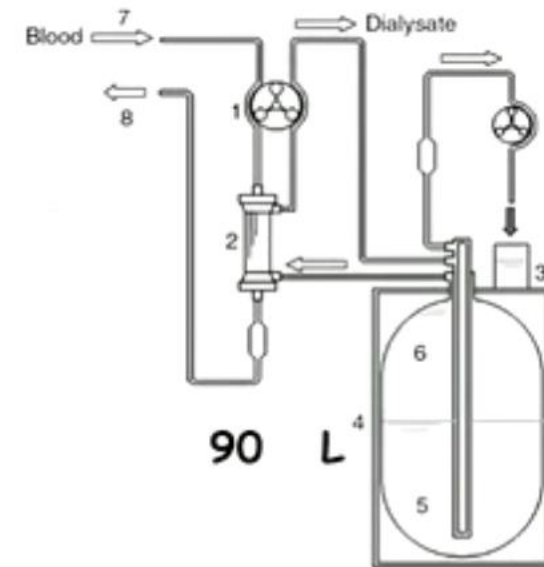
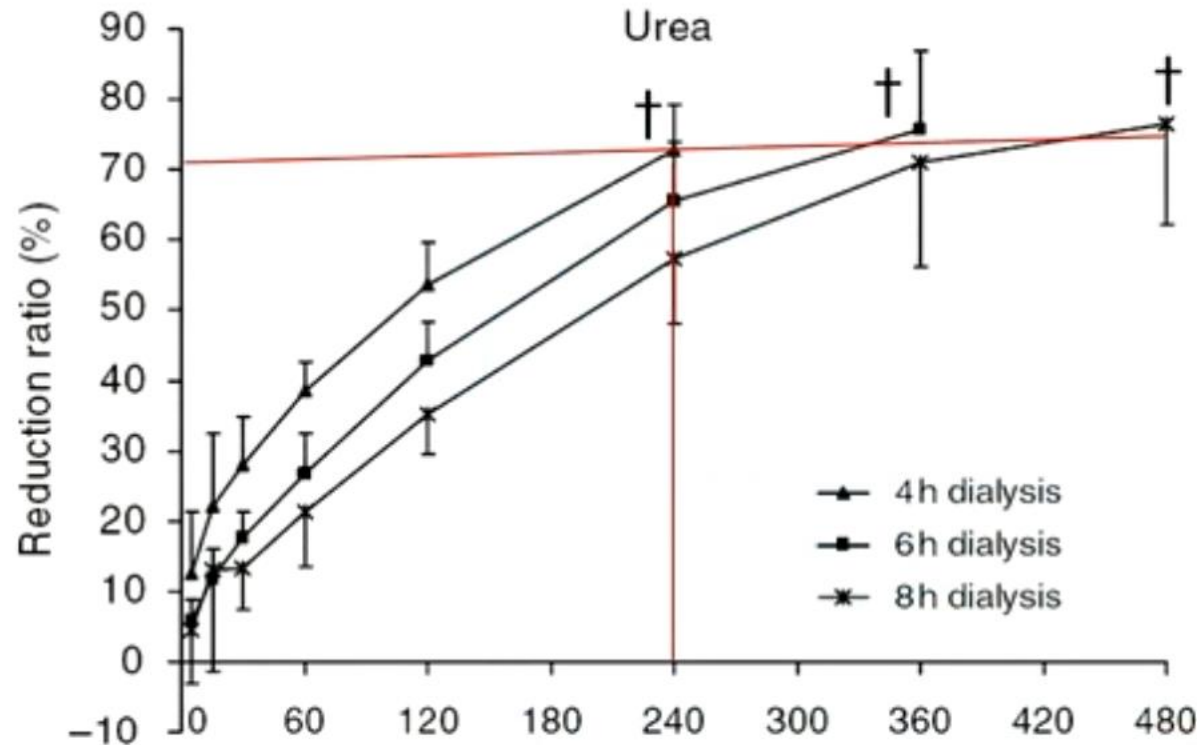
How toxic is urea ?

Is it urea ?



Treatment time and clearance

Urea - URR

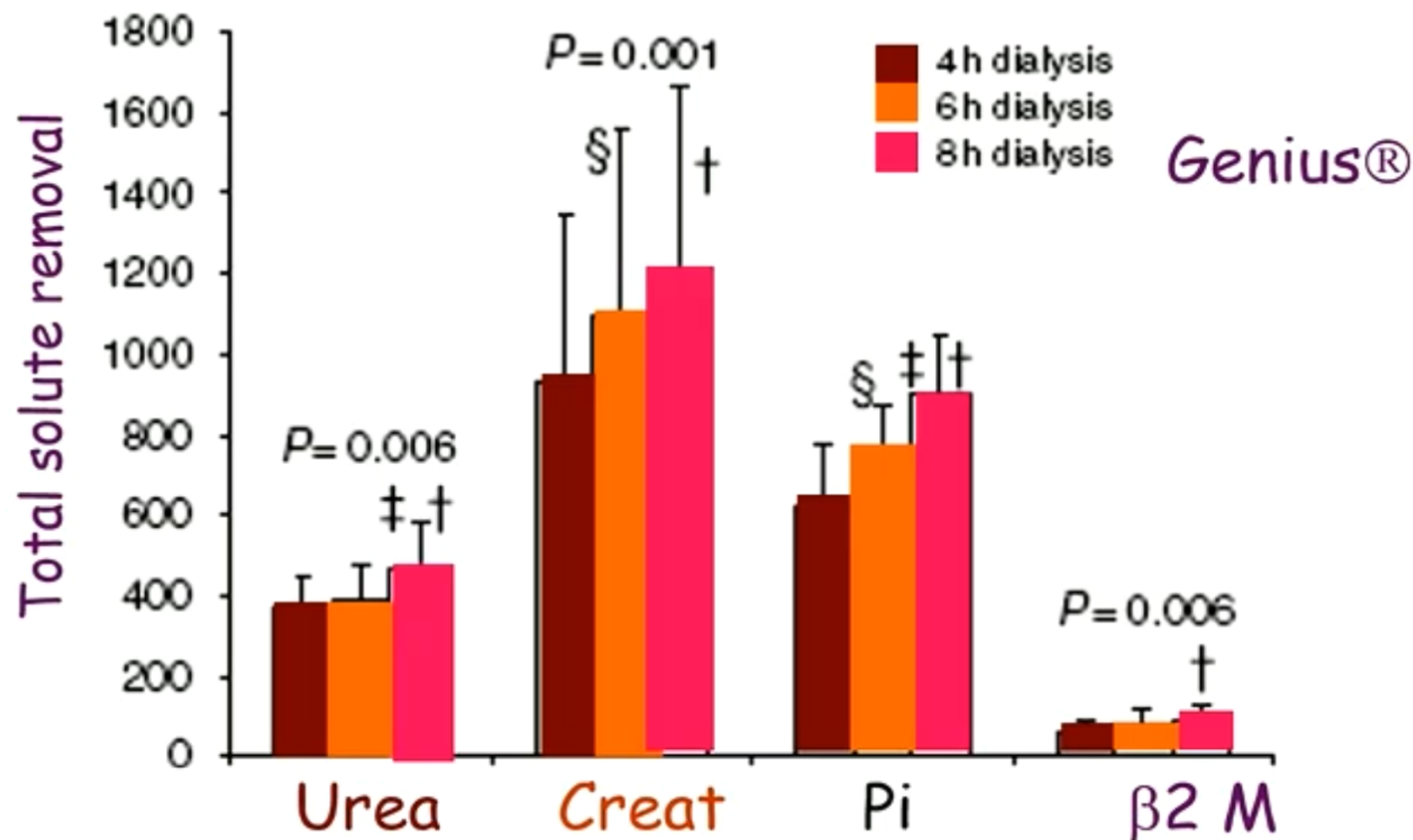


Genius®



Treatment time and clearance

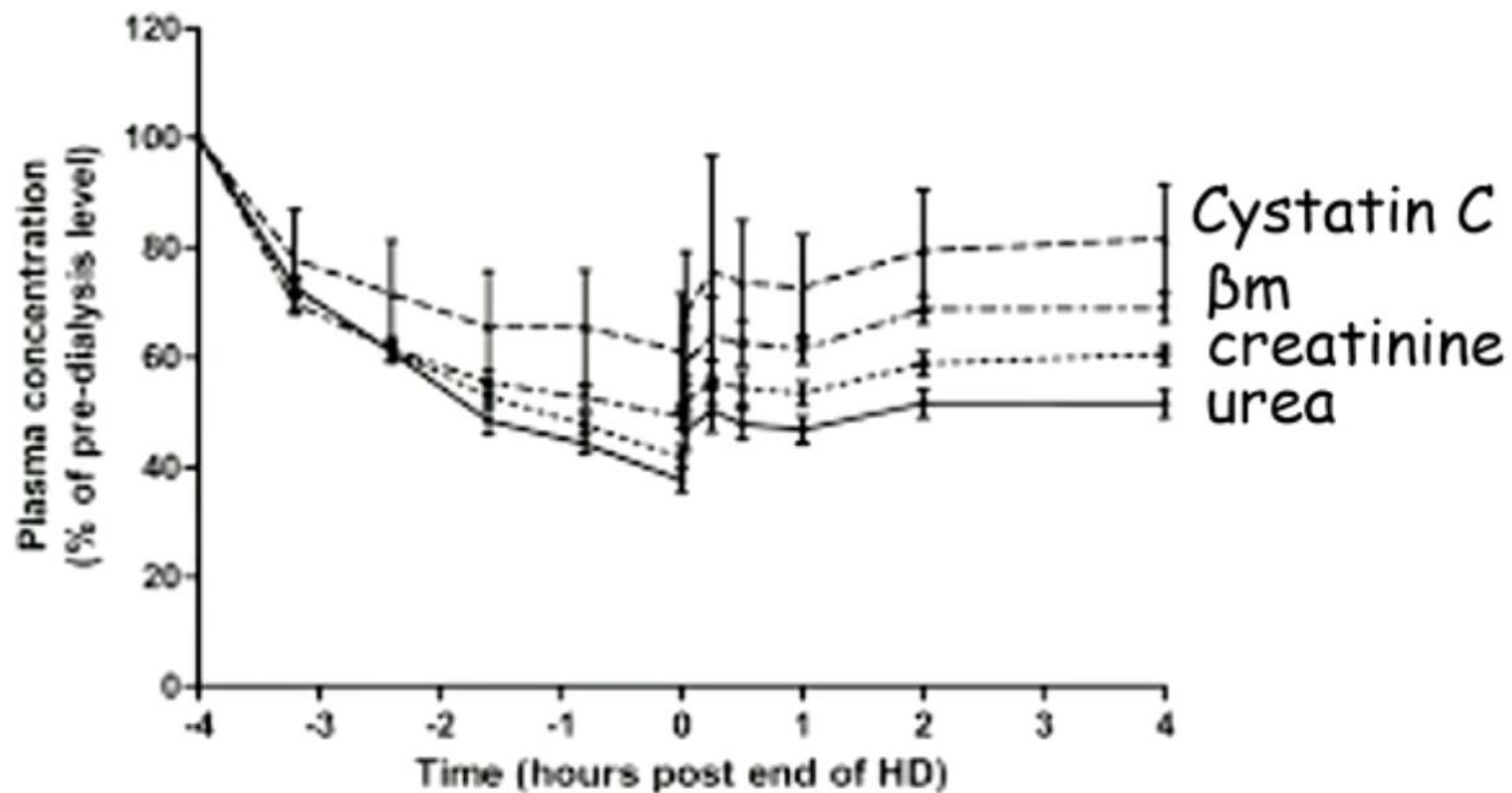
Eloot S, KI 73:765, 2008



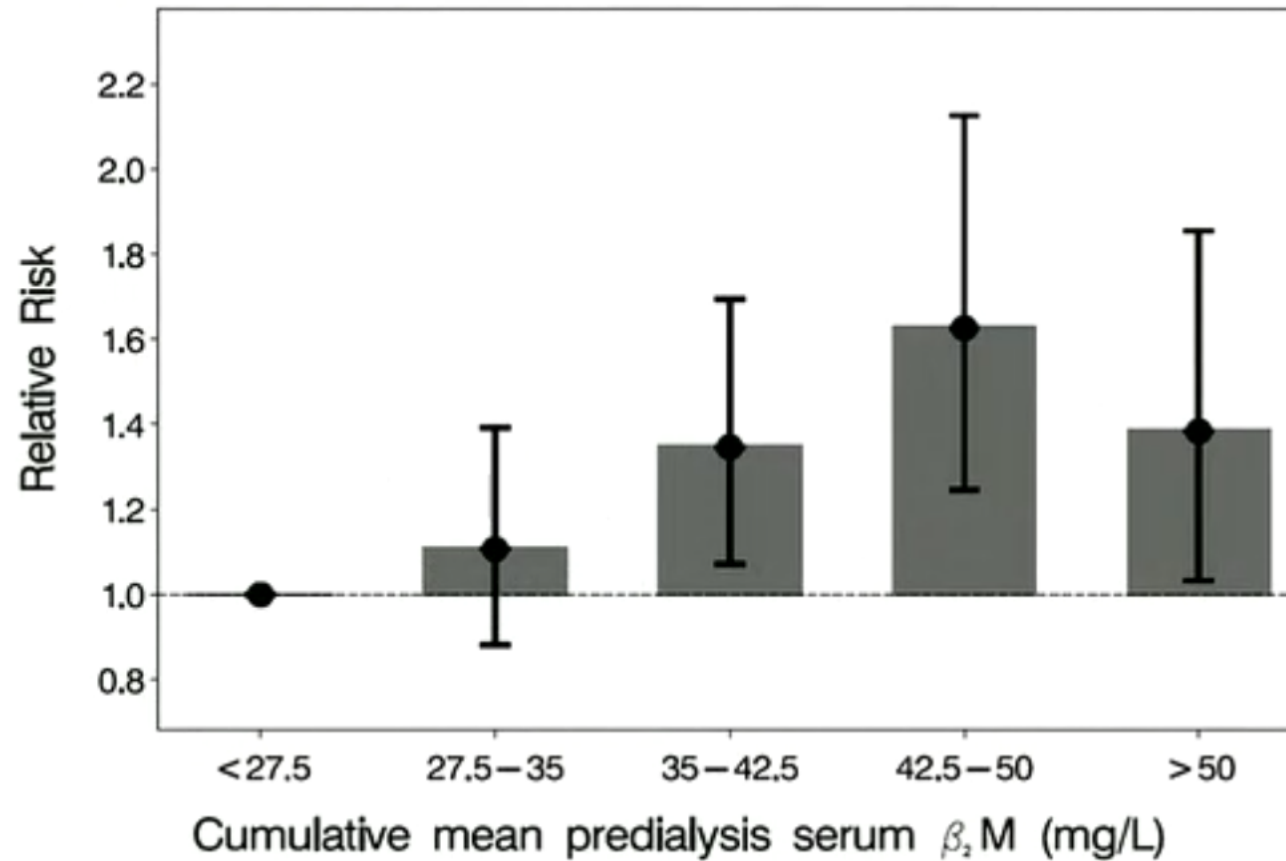
No benefit from greater Kt/Vurea



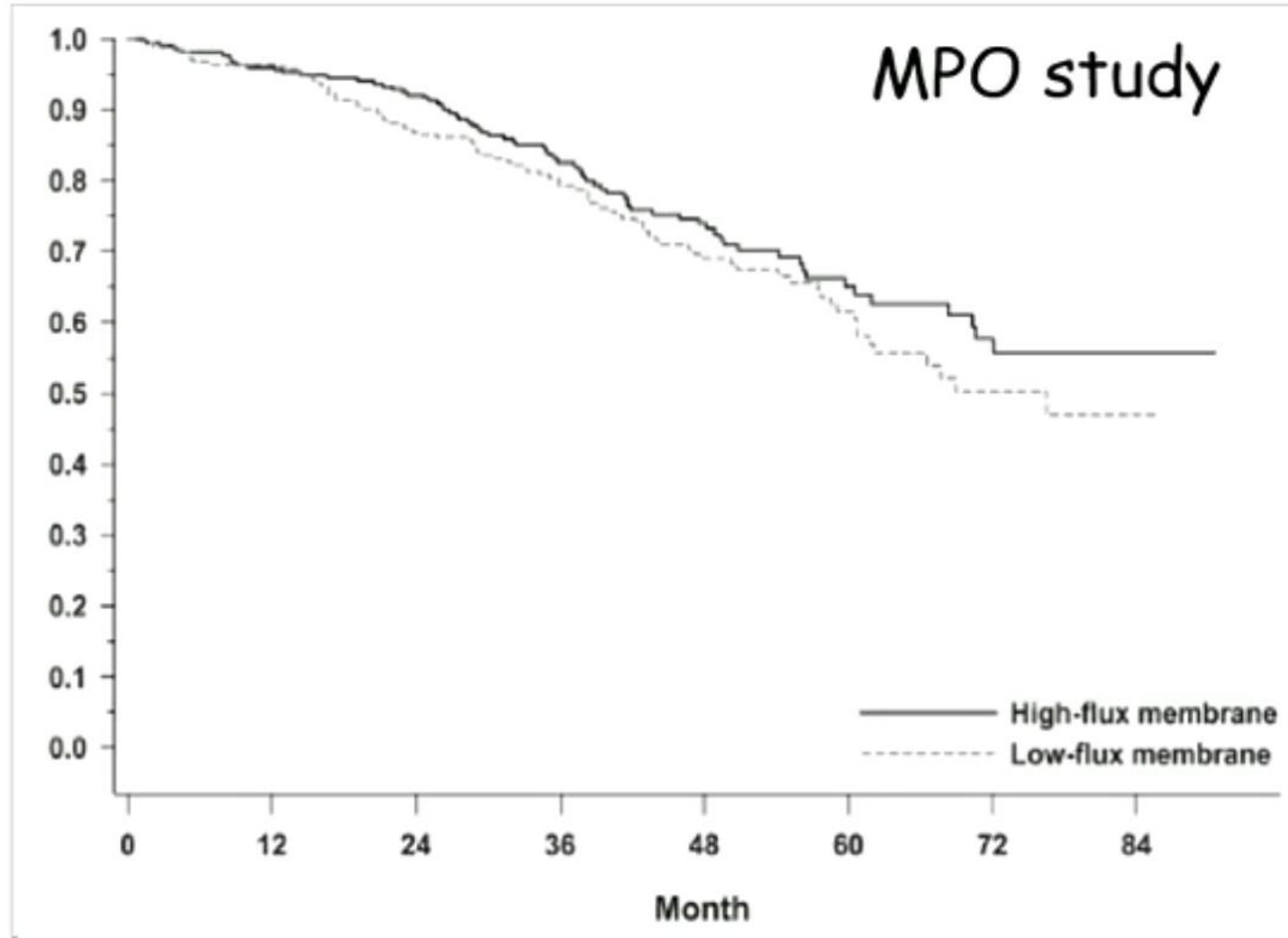
Is it urea ?



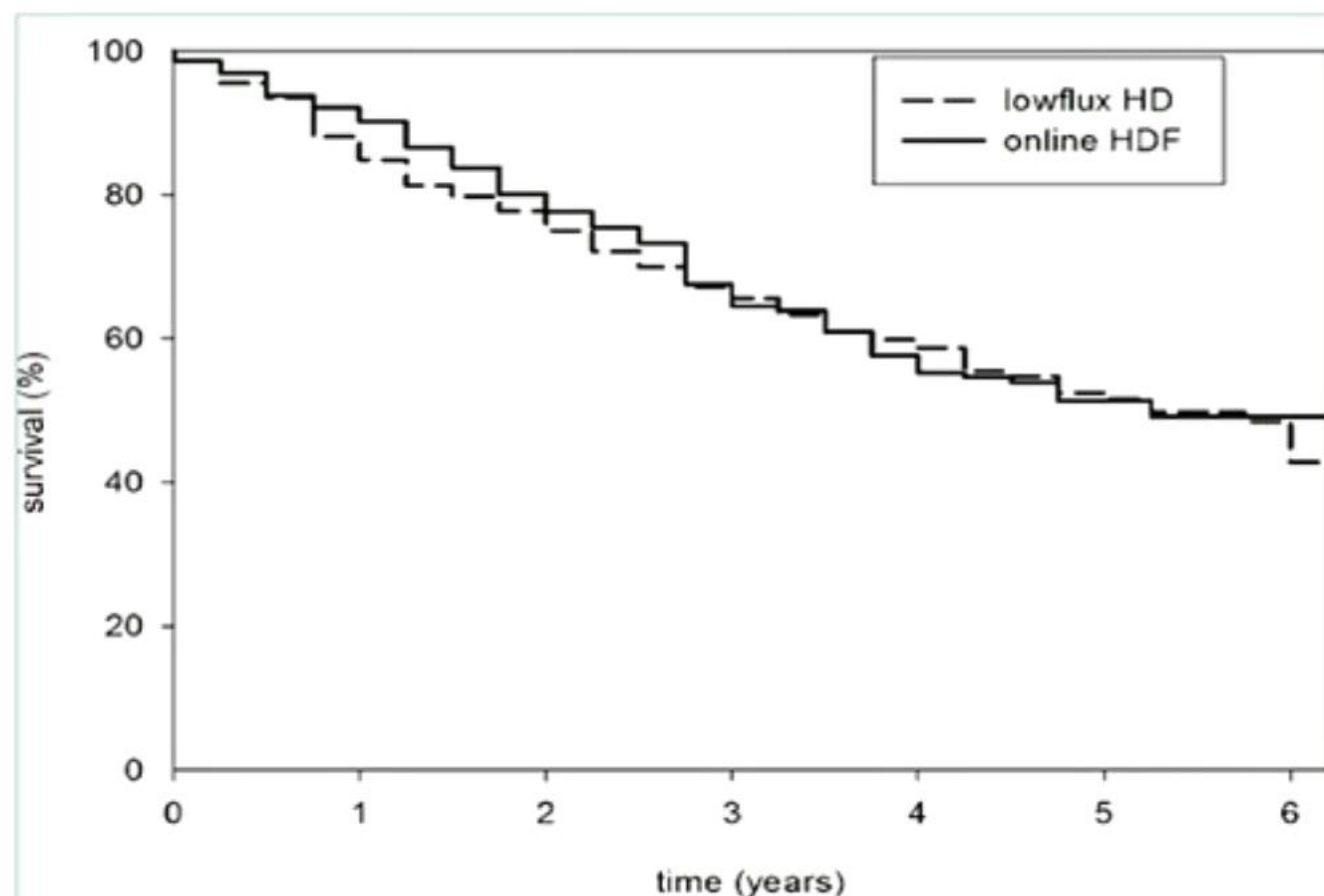
Post HEMO study analysis



No benefit from high flux dialysis



On line HDF vs low flux HD



Patients at risk

HD	356	337	307	269	230	201	169	140	102	83	65	52	32
HDF	358	346	324	287	237	203	160	131	103	77	57	44	18

Grooteman et al JASN 2012

Funding Fresenius, Gambro, DKF

Holland 597

Canada 102

Norway 15

Age 64 ± 14 years

50% β blockers

50% ACEIs/ARBs

Vintage

HD 2.1 (1.0-4.0) yr

HDF 1.8 (1.0-3.7) yr

52% UO > 100 ml/day

22-26% DM

Follow up 0.4-6.6 years

Median 2.9 yr

6.1 % 2 x week Rx

91% HDF sessions
delivered

Median (incl UF)

19.8 l/session

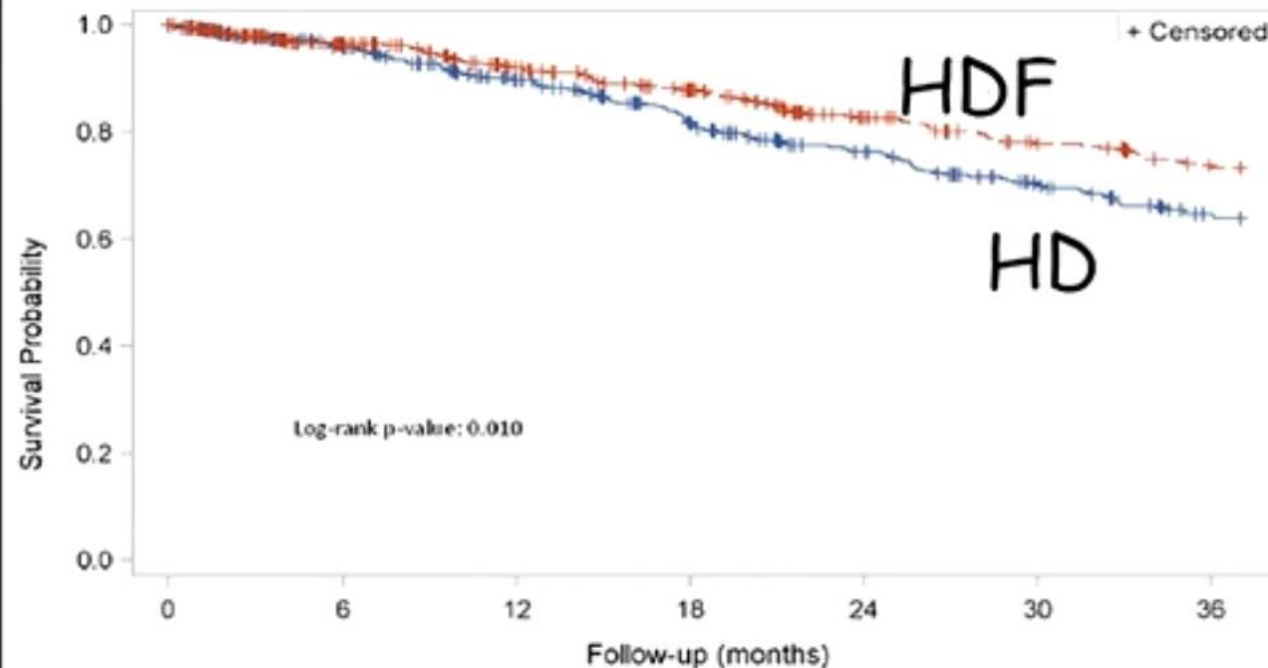


ESHOL study

Funding Fresenius, Gambro



Maduell et al JASN 2013



HD	450	388	327	275	235	196	165
OL-HDF	456	367	318	264	232	200	179

Age yr	HDF	64.5 ±14.4	vs	HD	66.3 ±14.3
DM %		22.8			27.1
CVC %		7.5			13.1*
Charlson		6.0 (5-8)			7.0 (5-8)

906 Catalonia
Vintage 28 (12-59) mo
? Residual renal function
57.8% BP meds

Lost to follow up
19.9% Tx
11.7% change Rx/unit
4.6% consent/other
2.1% access

Univariate Cox survival analysis

HDF	0.7 (0.53-0.92) **
Age 1yr	1.05 (1.03-1.06)***
DM	1.43 (1.07-1.91) *
Charlson	1.37 (1.28-1.47)***
CVC access	1.45 (1.2-1.46)***

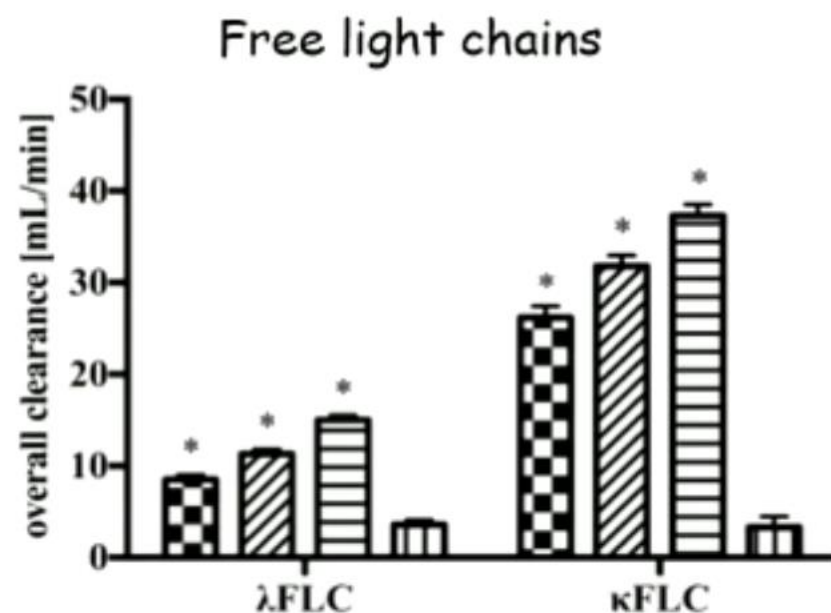


Alternatives to OL-HDF

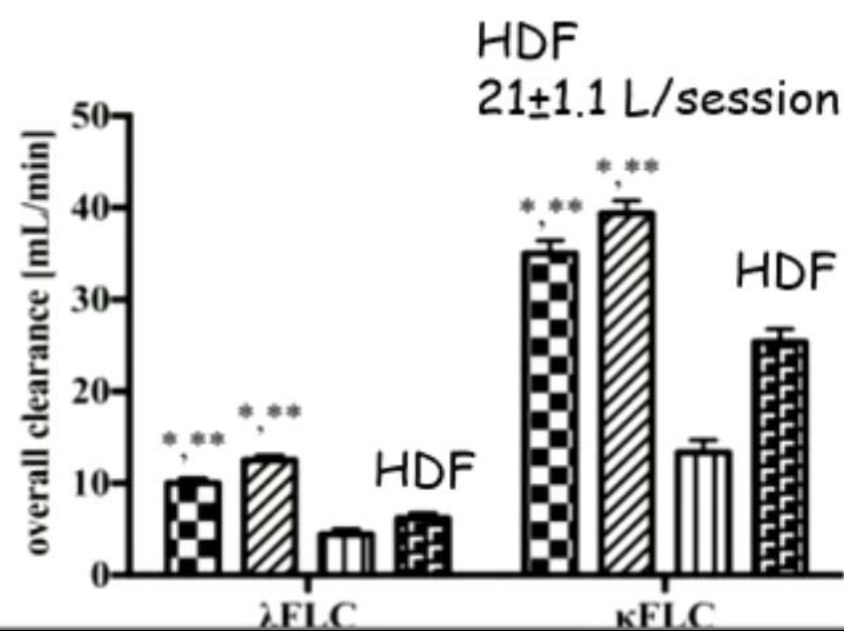
Kirsch et al NDT 2017



Higher permeability dialyzers



MCO AA HD	2.9 (1.5-3.9)
MCO BB HD	4.8 (2.2-6.7)
MCO CC HD	7.3 (1.9-9.7)
high-flux HD	0.2 (0.2-0.2)



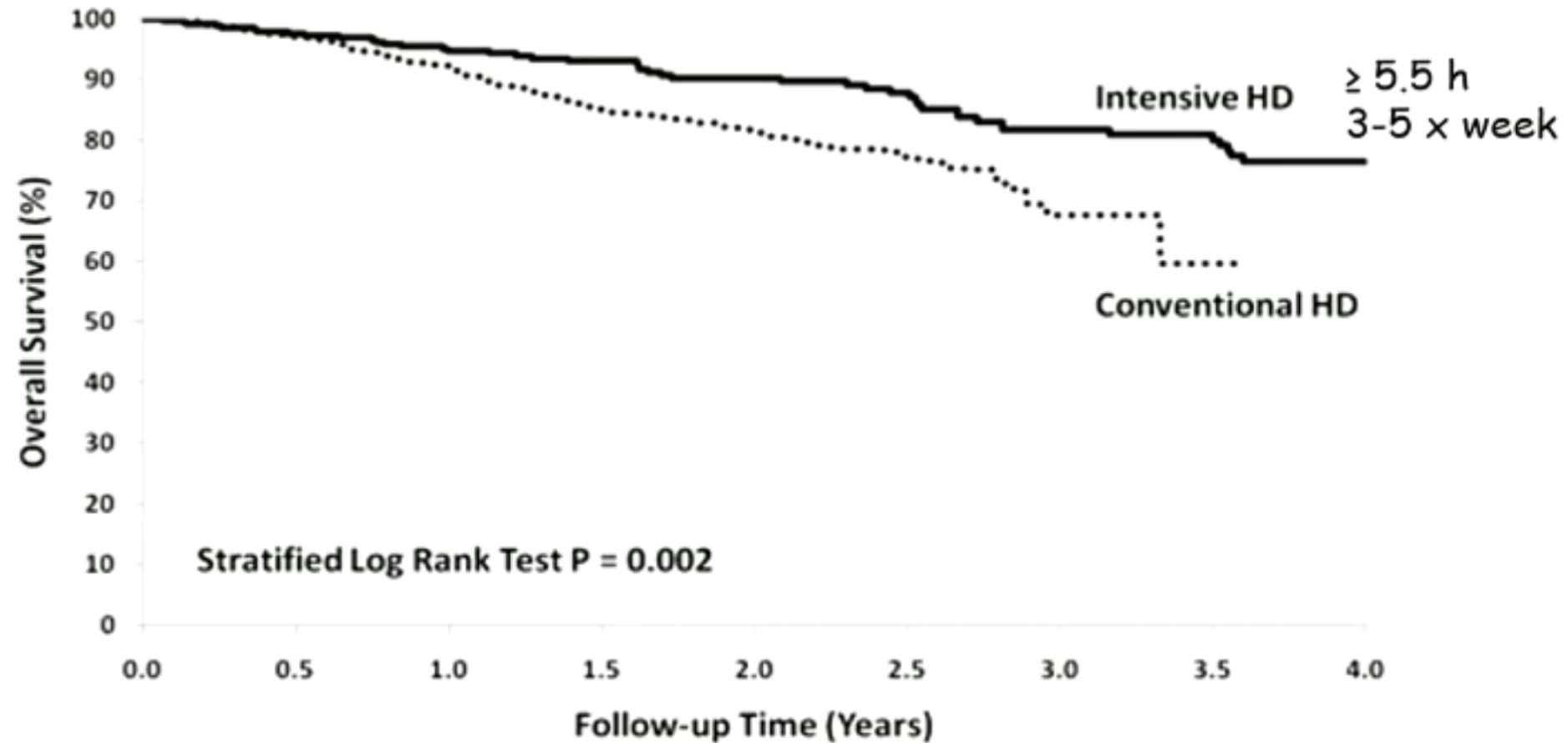
No benefit from greater Kt/Vurea



Do we need greater separation ?



Outcomes of extended hours haemodialysis



NCDS



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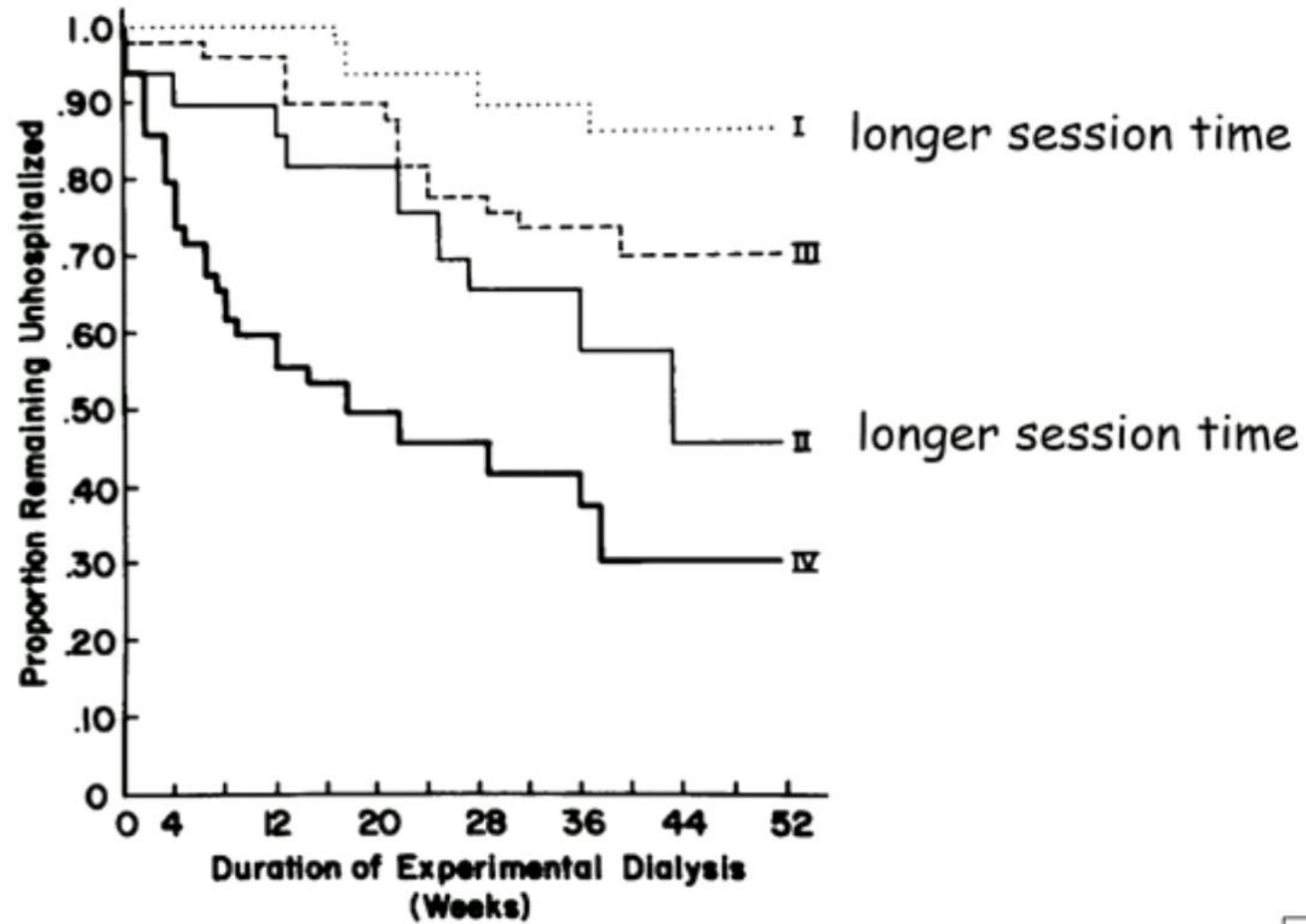
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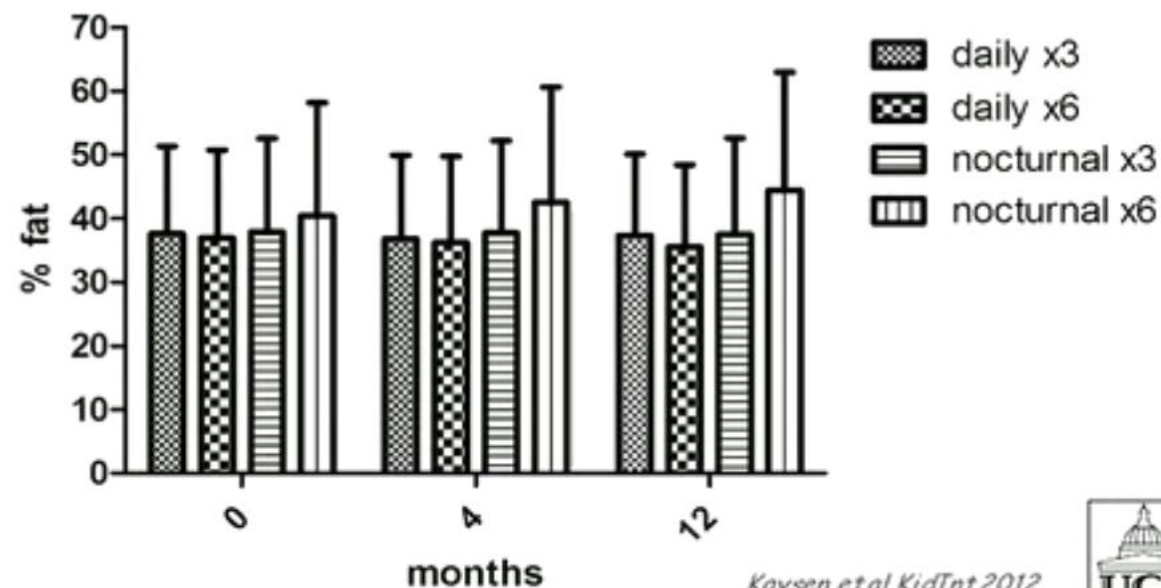
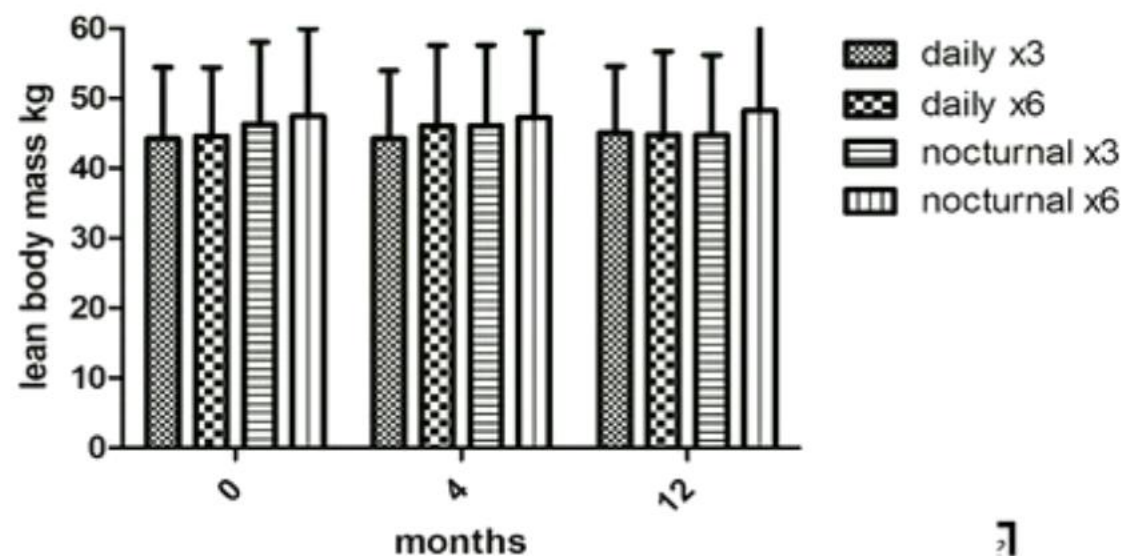






nutrition

- no difference
- ❖ albumin
- ❖ ePCR
- ❖ muscle mass
- ❖ fat



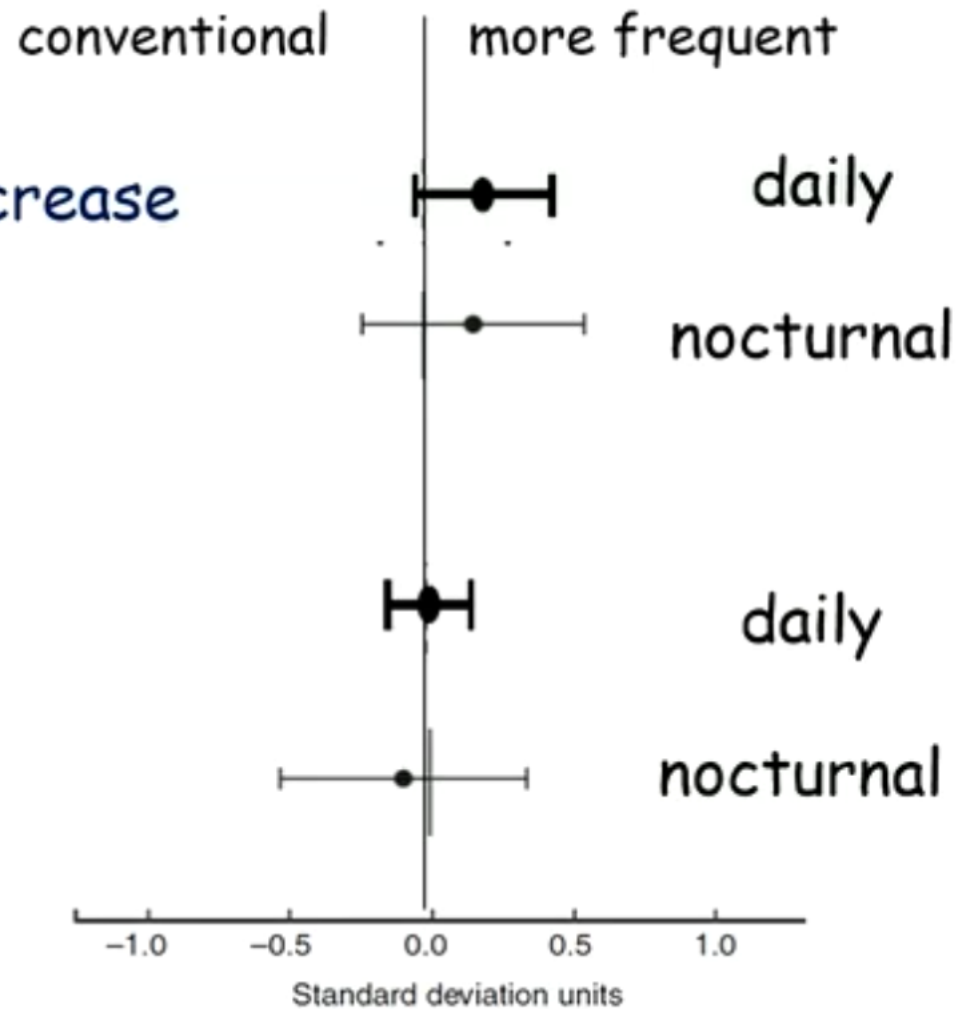
More frequent and longer dialysis

depression

Beck depression score mean decrease

higher mental function

Trial making B test
neg log relative risk



No benefit from greater Kt/V_{urea}

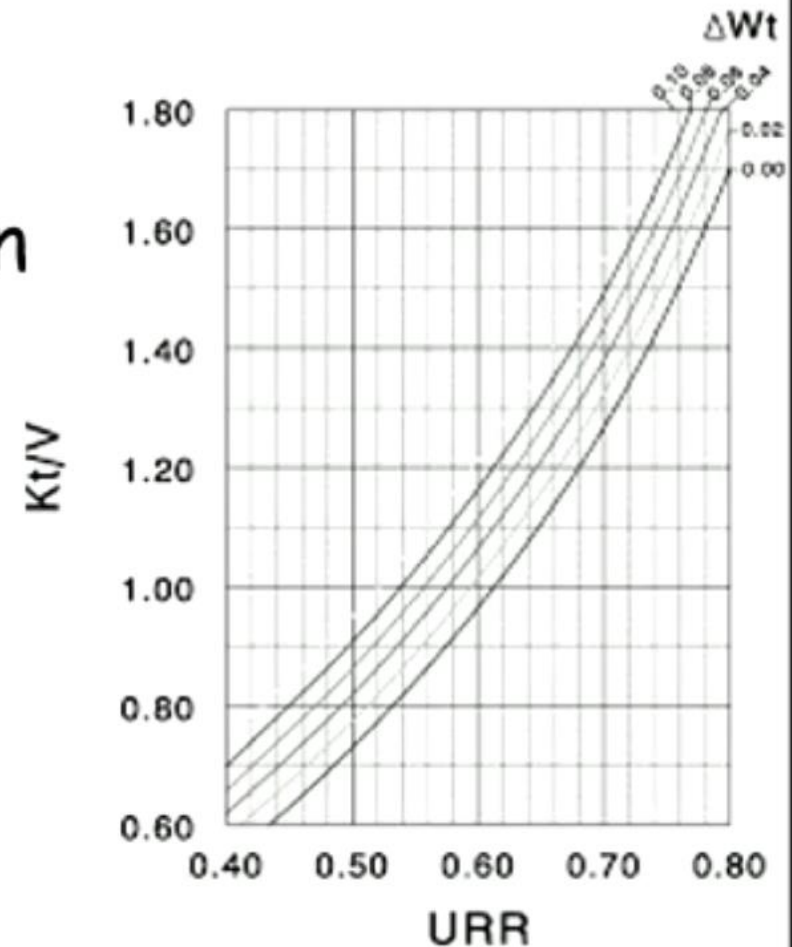


Is it the equation ?

K dialyzer urea clearance

t session time

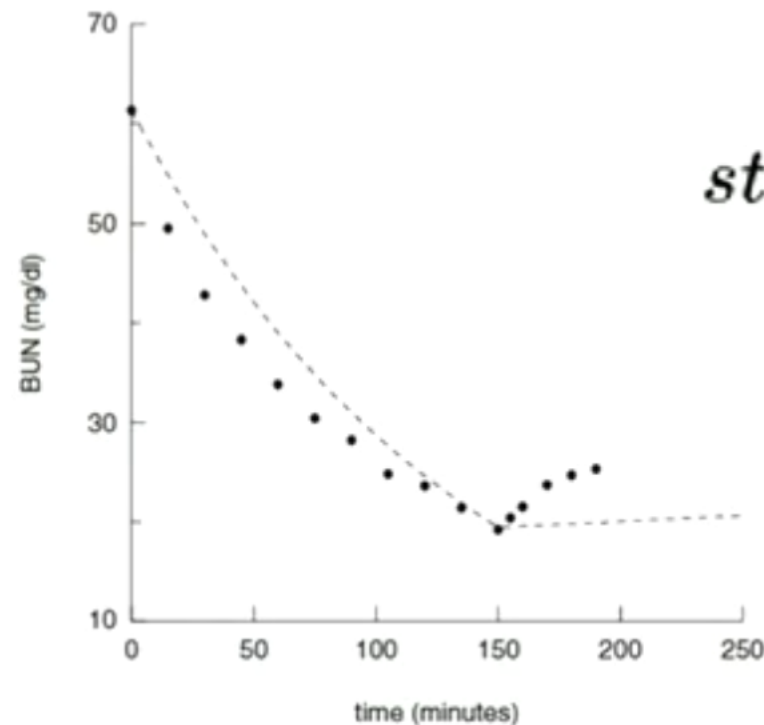
V volume of urea distribution



No benefit from greater Kt/Vurea



Is it the equation ?

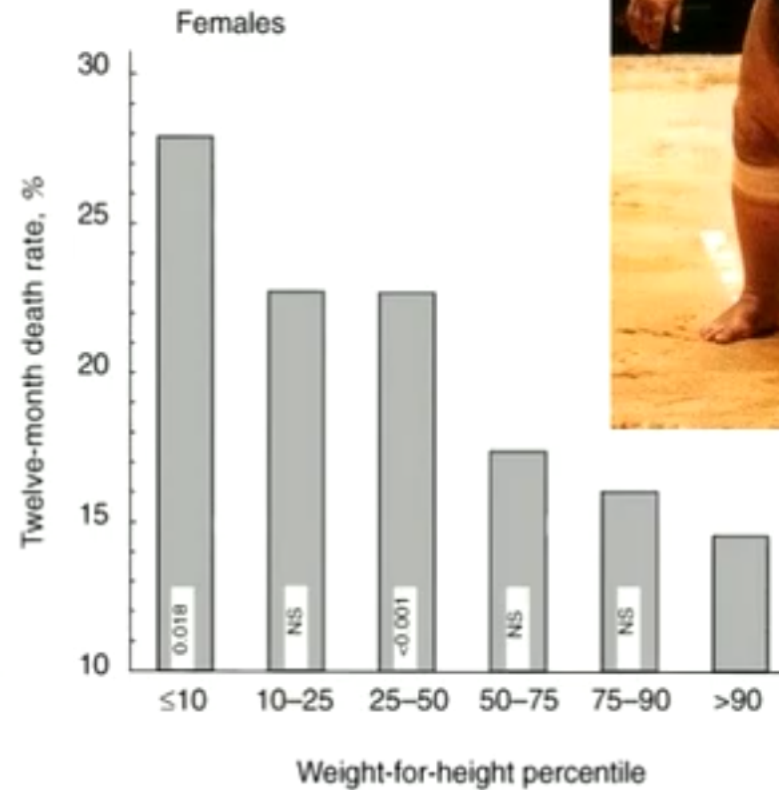
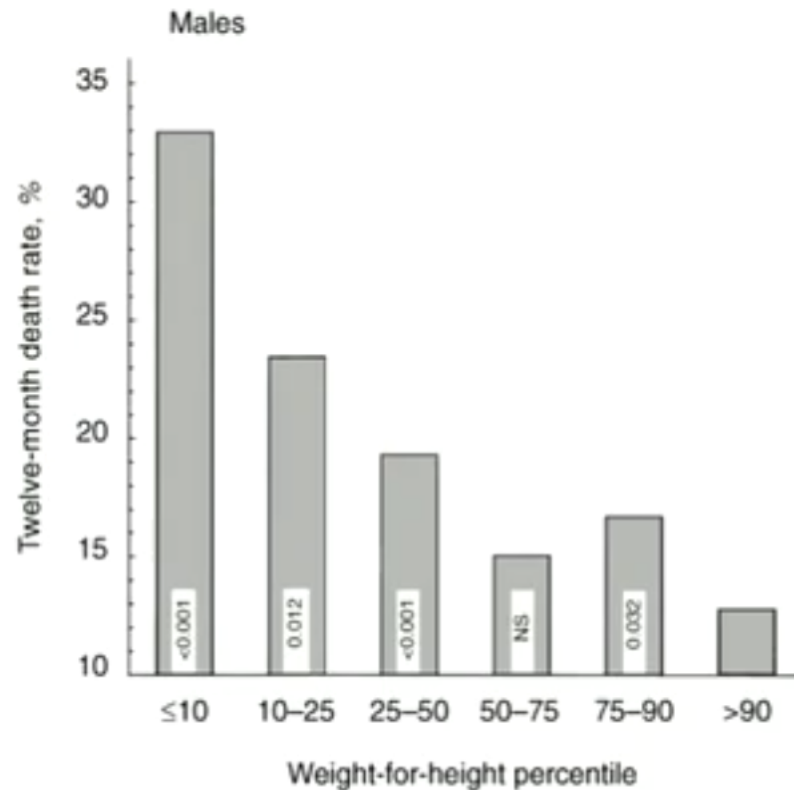


$$stdKt/V = \frac{\frac{10080 \cdot (1 - e^{-eKt/V})}{t}}{\frac{1 - e^{-eKt/V}}{spKt/V} + \frac{10080}{N \cdot t} - 1}$$

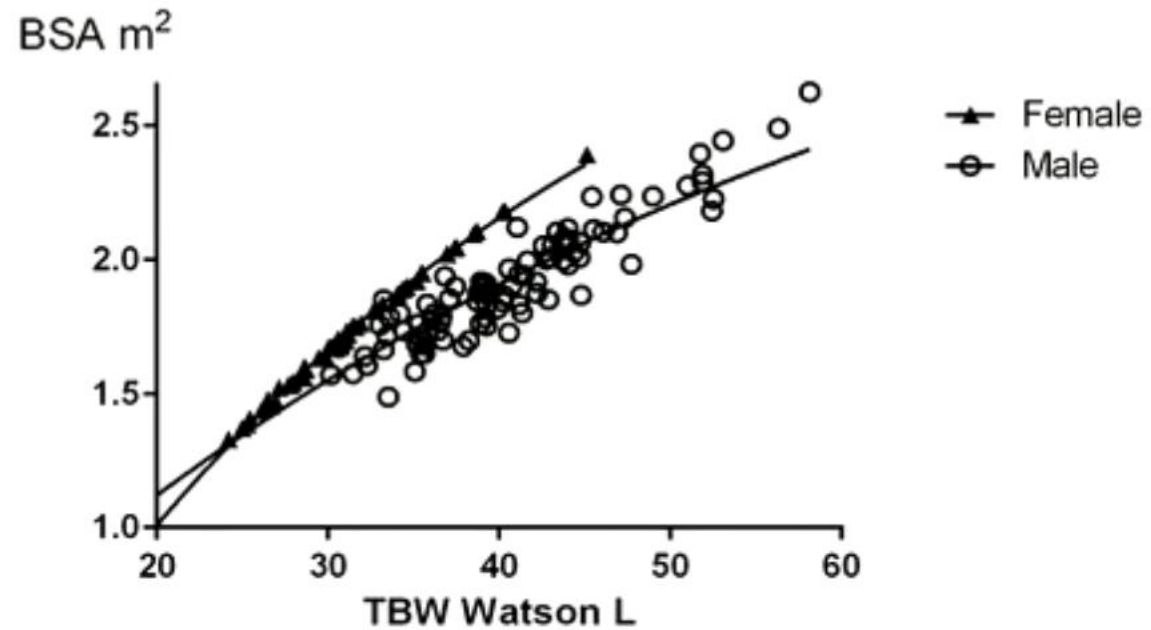


But size matters

Kopple et al Kid Int 1999



Dose based on "V"



Energy expenditure

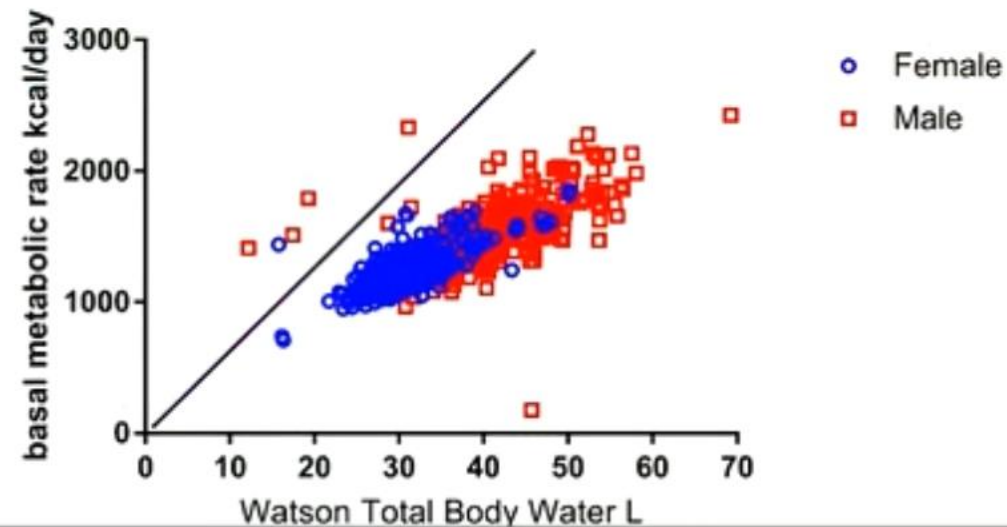
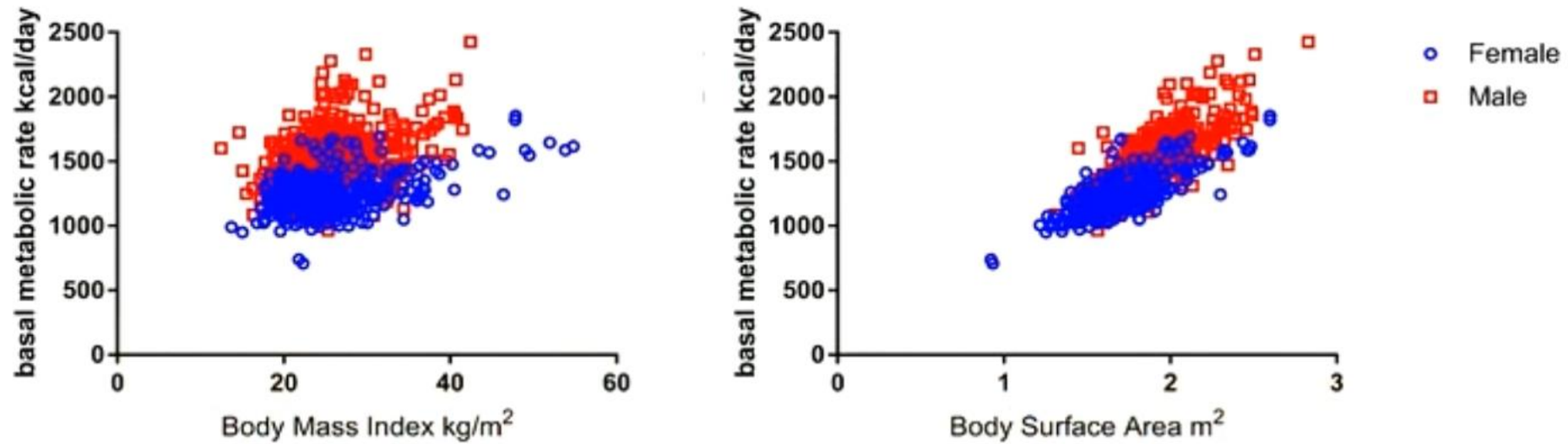
Resting EE, Active EE, Total EE



Cell metabolism generates waste products

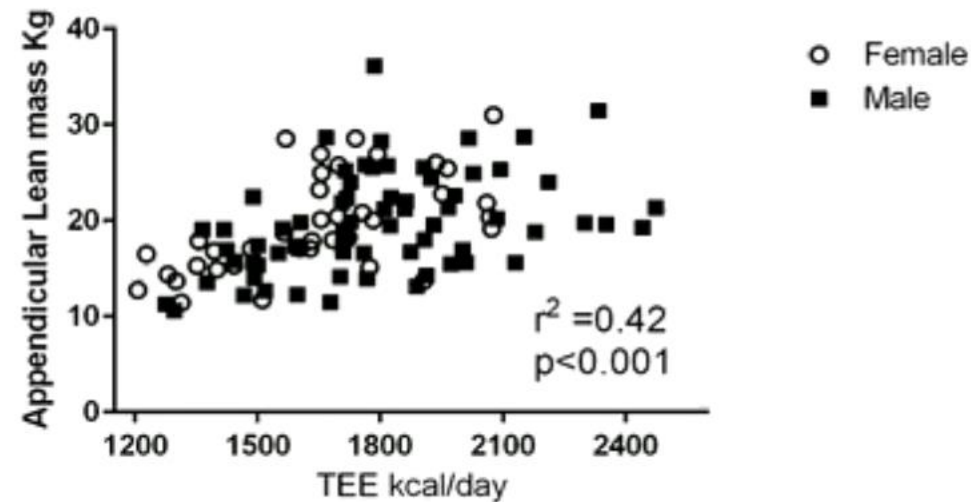
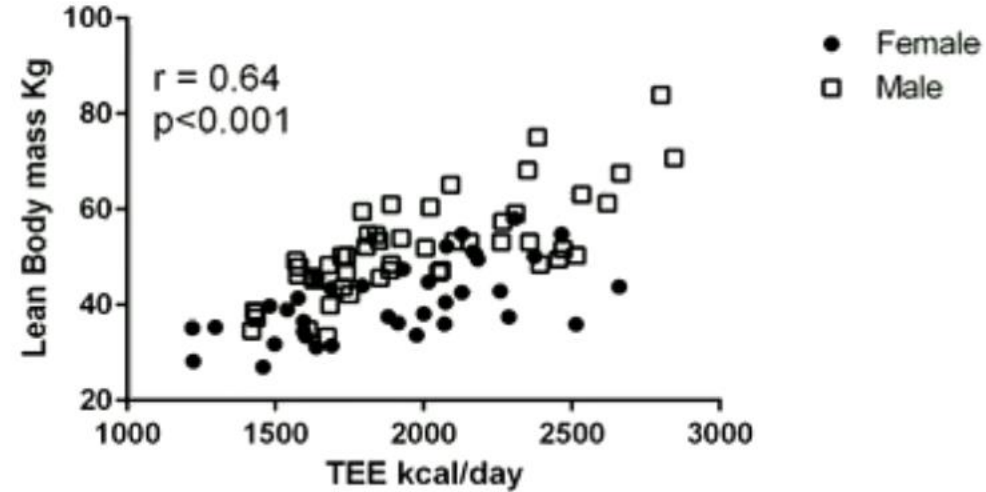


Basal metabolic rate



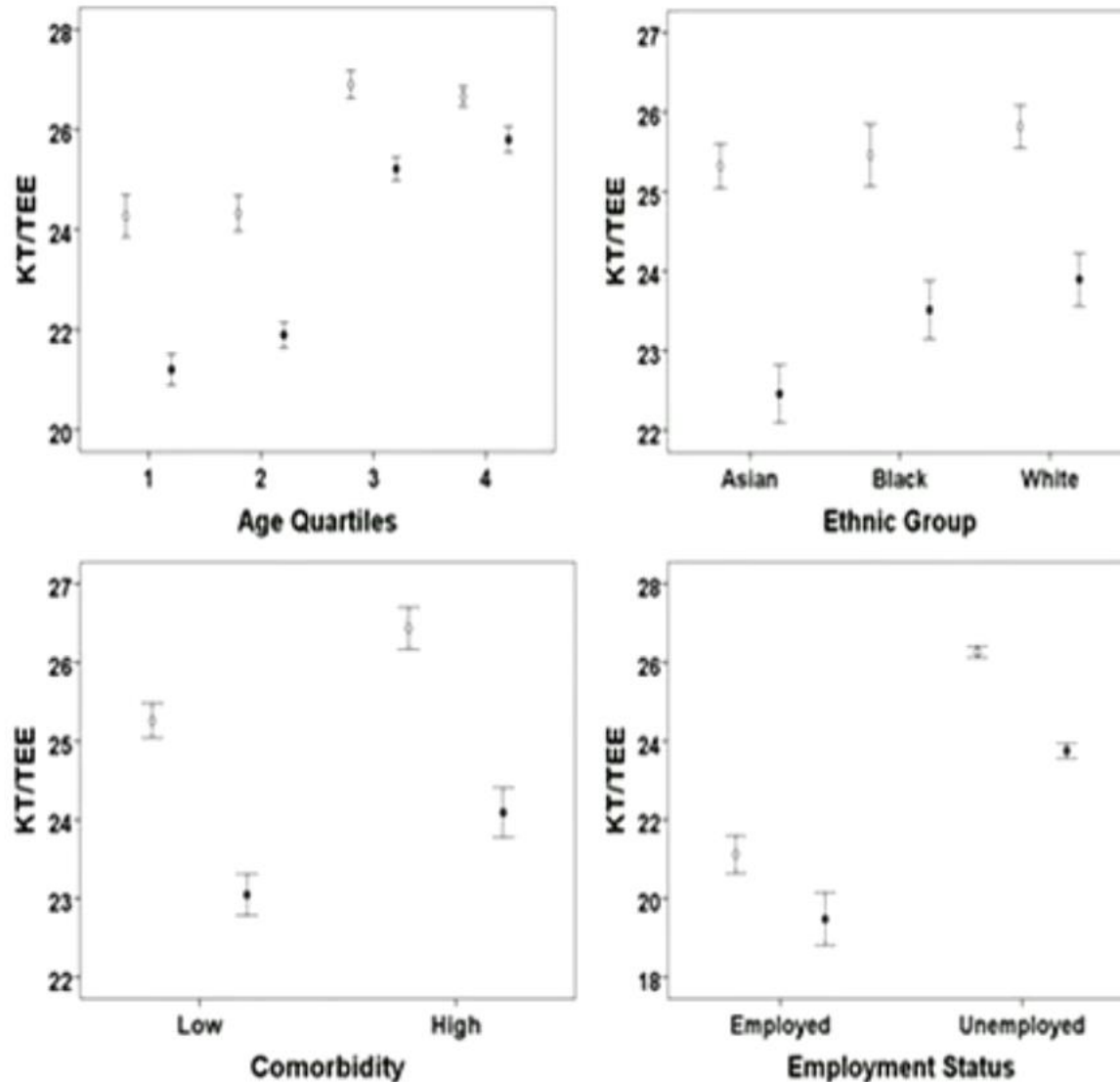
Energy expenditure

Resting EE, Active EE, Total EE



Same Kt/V

Equivalent dialysis dose



Adult patient specific dosing based on TEE



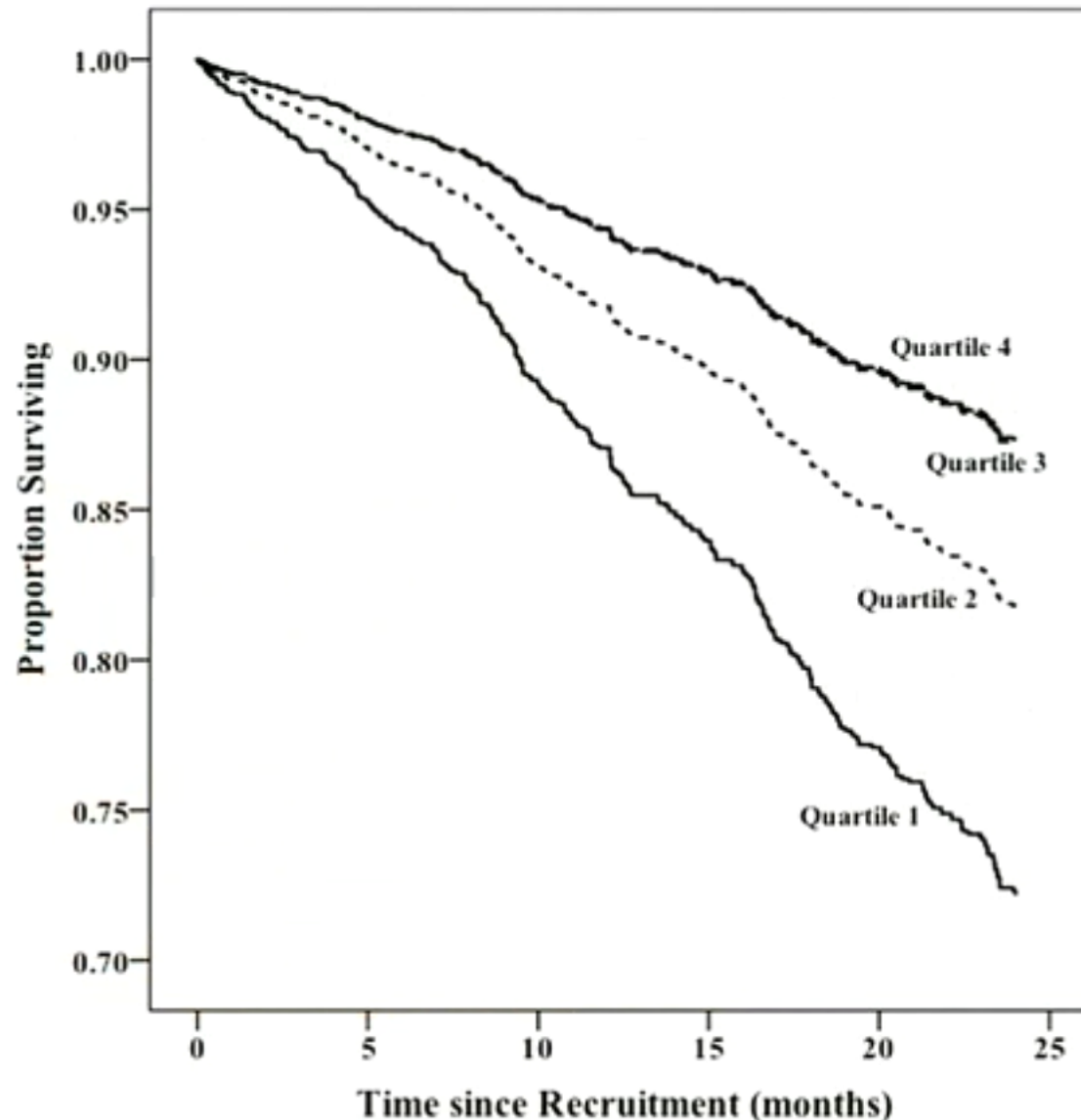
Some adult patients need greater clearance



- younger
- women
- smaller
- less co-morbidity
- employed



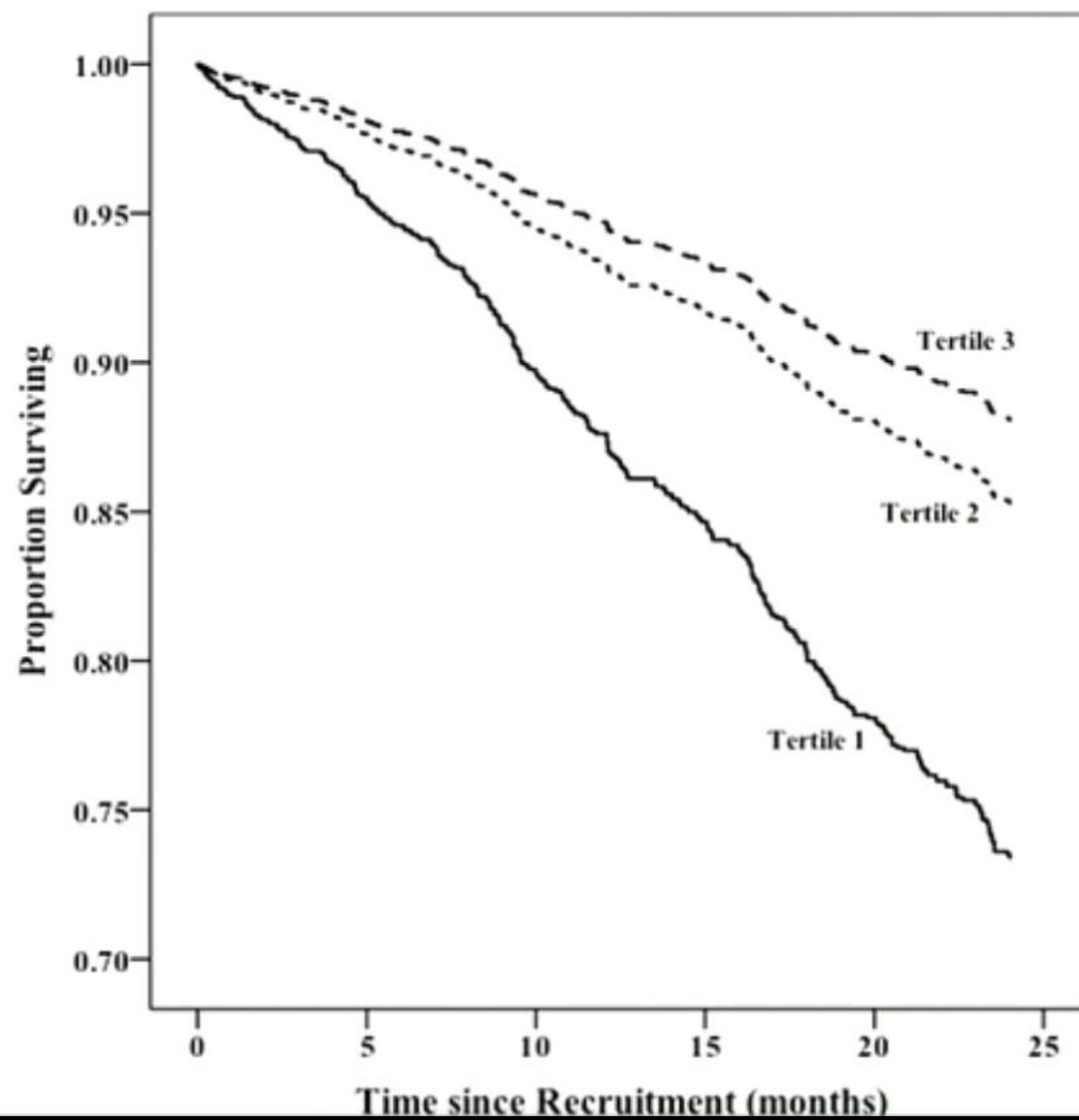
Adult patient specific dosing based on BSA



Kt/BSA quartiles
adjusted for age, sex,
ethnicity, comorbidity,
dialysis vintage, BMI
and physical activity level



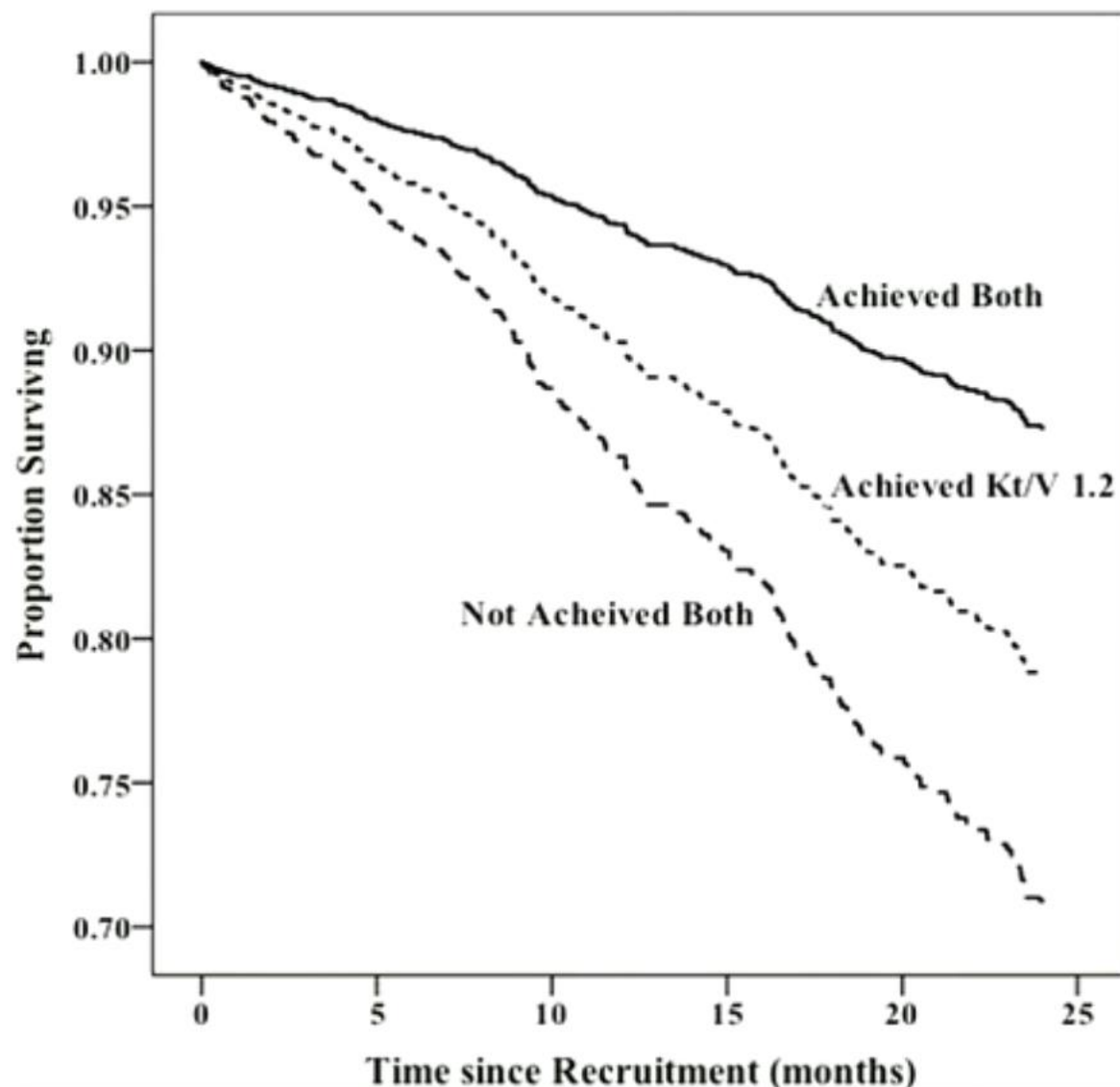
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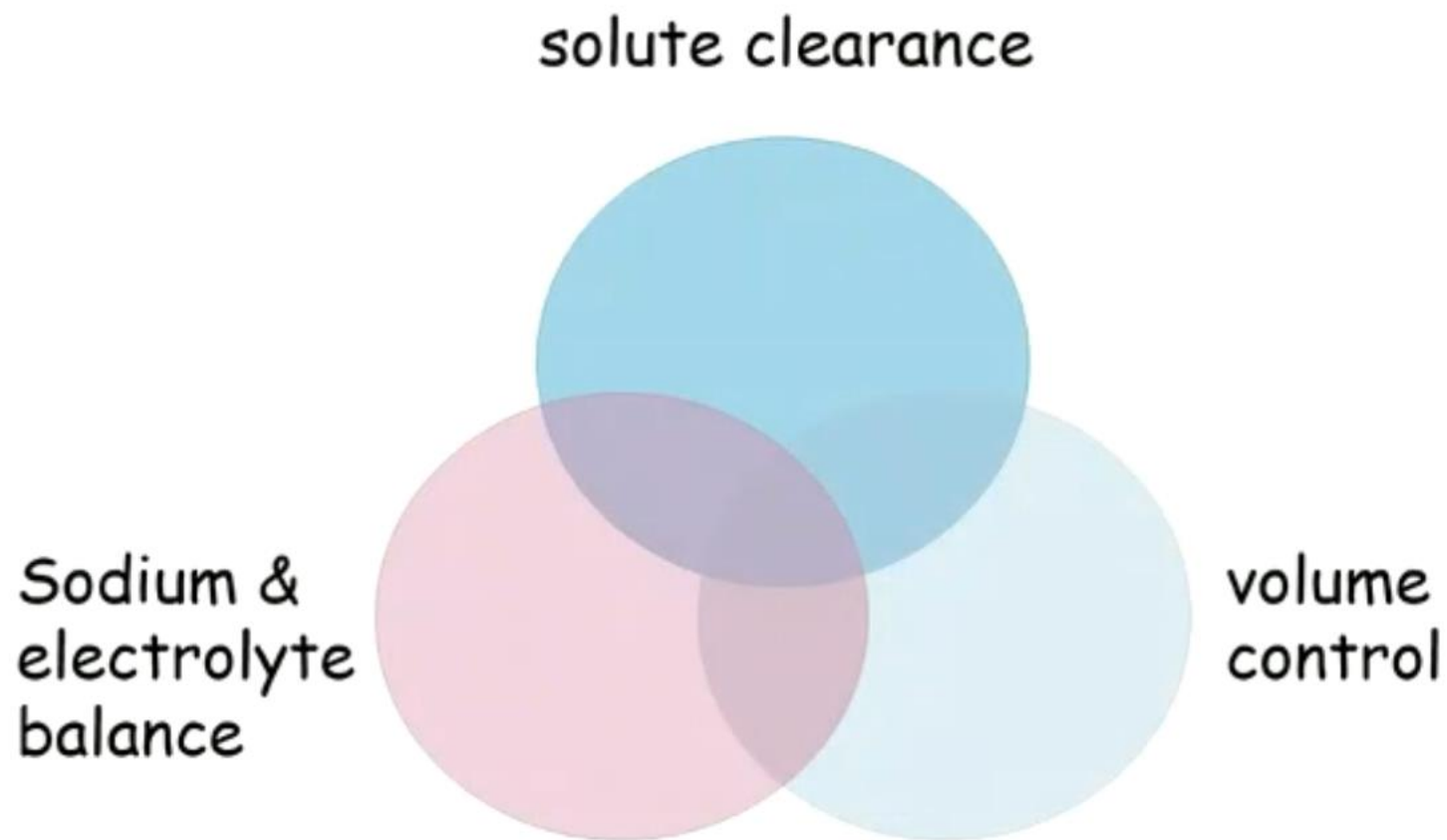
Adult patient specific dosing based on TEE



Kt/TEE tertiles
adjusted survival
according to achievement
of recommended spKt/V
adequacy targets based on
gender, body size and
physical activity and by
conventional criteria
($\text{spKt/V} > 1.2$)



Dialysis prescription



Patient specific prescription

One size does not fit all



tailored to residual renal function
and energy expenditure



adult haemodialysis adjust Kt for TEE (BSA)



Some adult patients need greater clearance



- younger
- women
- smaller
- less co-morbidity
- physically active





prescribing dialysis
treat patients as individuals



Thank you

