Universitair Ziekenhuis Gent

UNIVERSITEIT GENT

DURATION OF DIALYSIS

R Vanholder
Universitair Ziekenhuis
Gent

Universitair Ziekenhuis Gent

UNIVERSITEIT GENT

DURATION OF DIALYSIS

R Vanholder
Universitair Ziekenhuis
Gent

IMPACT ON REMOVAL AND OUTCOME OF EXTENDED ALTERNATE DAY DIALYSIS

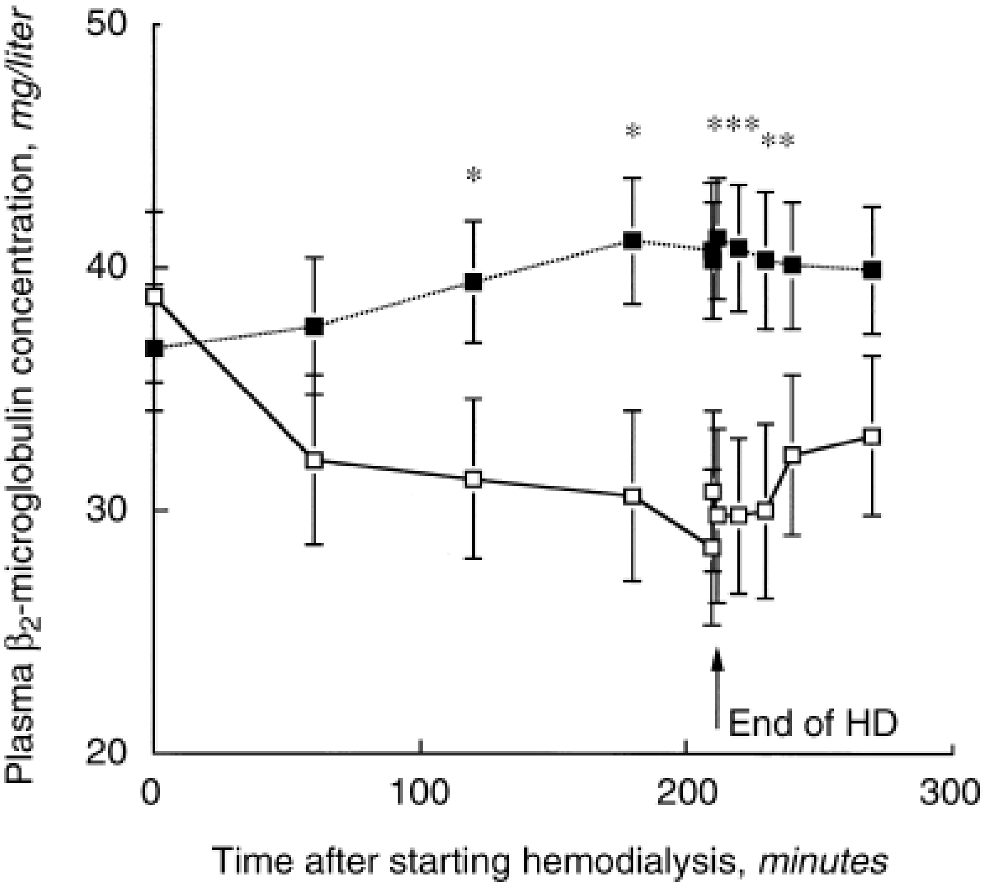
Table 2 | Effect of long thrice-weekly haemodialysis

Parameter	Type of study	Effect	References
Removal			
Urea	Two randomized crossover trials	Improvement	Eloot *et al.* (2008);[25] Basile *et al.* (2011)[95]
Creatinine	Two randomized crossover trials	Improvement	Eloot *et al.* (2008);[25] Basile *et al.* (2011)[95]
Phosphate	Two randomized crossover trials, two follow-up studies	Improvement	Eloot *et al.* (2008);[25] Haag-Weber (2003);[93] Alloatti *et al.* (2002);[94] Basile *et al.* (2011)[95]
β_2-microglobulin	Two randomized crossover trials	Improvement	Eloot *et al.* (2008);[25] Basile *et al.* (2011)[95]
Kt/V_{urea}	Two randomized crossover trials	No difference	Eloot *et al.* (2008);[25] Basile *et al.* (2011)[95]
Protein-bound solutes	Randomized crossover trial	No difference	Basile *et al.* (2011)[95]
Outcome			
Survival	One comparison of two units with different strategies, one observational cohort study	Improvement	Innes *et al.* (1999);[96] Lockridge *et al.* (2009)[97]
Quality of life	Randomized crossover trial	Improvement	McGregor *et al.* (2001)[98]
Intradialytic haemodynamic stability	Literature review	Improvement	Charra *et al.* (2003)[99]
Blood pressure control	Two follow-up studies, one randomized crossover study, two cross-sectional cohort studies, one literature review	Improvement	Haag-Weber (2003);[93] Alloatti *et al.* (2002);[94] McGregor *et al.* (2001);[98] Charra *et al.* (2003);[99] McGregor (1999);[100] Chazot (1995)[101]
ESA need	Two follow-up studies	Improvement	Haag-Weber (2003);[93] Alloatti *et al.* (2002)[94]
Body weight	Follow-up study	Improvement	Alloatti *et al.* (2002)[94]
Sympathetic activity	Randomized crossover trial	Improvement	McGregor *et al.* (2001)[98]
Parasympathetic activity	Randomized crossover trial	Improvement	McGregor *et al.* (2001)[98]
Burden on social life	Randomized crossover trial	Improvement	McGregor *et al.* (2001)[98]
Arterial stiffness	Prospective matched control study	Improvement	Demirci *et al.* (2012)[102]
Cardiovascular morbidity	Retrospective comparison, case–control study	Improvement	Flythe *et al.* (2011);[103] Ok *et al.* (2011)[104]
Cardiovascular mortality	Retrospective comparison, case–control study	Improvement	Ok *et al.* (2011);[103] Ok *et al.* (2011)[104]

Abbreviation: ESA, erythropoiesis-stimulating agent.

Vanholder et al, Nat Rev Nephrol, 8:579-588; 2012

KINETICS MIDDLE MOLECULES



Leypoldt et al, KI, 56: 1571-1577; 1999

KINETICS MIDDLE MOLECULES: β2M

	ref	K_{12} (L)	V_{tot}	V_2/V_1	G mg/kg/d
urea	Eloot	822±345	42.7±6.0	7.16±4.06	238±86
B_2M	Stiller	56.3±25.7	10.0±1.6	4.6±1.8	2.50±0.66
	Odell	42.9±6	12.7±1.8	2.8±0.8	3.76±0.88

Eloot et al, KI, 67: 1566-1575; 2005
Stiller et al, IJAO, 25: 411-420; 2002
Odell et al, KI, 39: 909-919; 1991

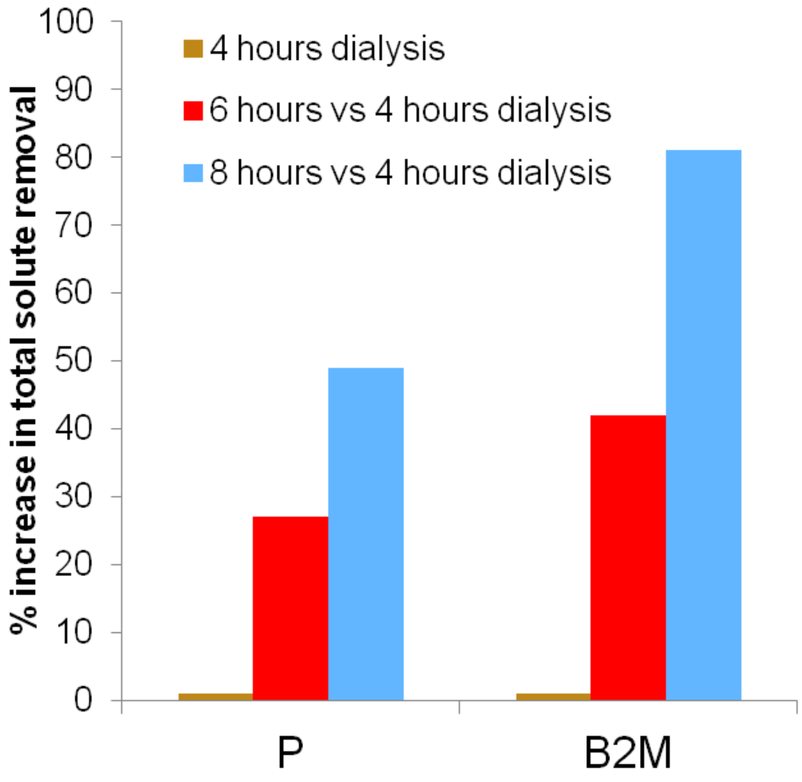
KINETICS MIDDLE MOLECULES: β2M

	ref	K_{12} (L)	V_{tot}	V_2/V_1	G mg/kg/d
urea	Eloot	822±345	42.7±6.0	7.16±4.06	238±86
B_2M	Stiller	56.3±25.7	10.0±1.6	4.6±1.8	2.50±0.66
	Odell	42.9±6	12.7±1.8	2.8±0.8	3.76±0.88

Eloot et al, KI, 67: 1566-1575; 2005
Stiller et al, IJAO, 25: 411-420; 2002
Odell et al, KI, 39: 909-919; 1991

INCREASING LENGTH OF DIALYSIS WITHOUT CHANGING ANY OTHER PARAMETER IMPROVES REMOVAL

Percentage change vs. 4 hrs



	4 hrs	6 hrs	8 hrs	P
QB and QD	72L	72L	72L	NS
Kt/V	1.4 ±0.3	1.6 ±0.6	1.5 ±0.5	NS

Eloot et al, KI, 73: 765-770; 2007

REMOVAL OF PROTEIN BOUND SOLUTES WITH LONG VS. STANDARD DIALYSIS IS NOT DIFFERENT

	RR 4 h (%)	RR 8 h (%)	% increase (8 h vs 4 h)	P[a]
Urea	69.3 (4.9)	74.6 (4.8)	7.6	< 0.0004
Creatinine	62.7 (6.7)	65.9 (5.7)	5.1	< 0.03
Uric acid	75.8 (6.4)	79.9 (5.3)	5.4	< 0.002
Phosphorus	40.9 (12.5)	50.7 (13.8)	23.9	< 0.01
β_2M	58.9 (8.4)	65.3 (8.3)	10.9	< 0.01
Homocysteine	45 (22.2)	51 (15.8)	13.3	0.185
Hippuric acid	53.3 (10.4)	57 (13.5)	7.5	0.428
Indole-3-acetic acid	44.7 (9.4)	46.5 (11.3)	4.9	0.651
Indoxyl sulphate	61.4 (17.0)	71.5 (19.6)	16.3	0.102

Means (SD).
[a]Student's *t*-test for unpaired data.

Table 5 Reduction ratios (RRs) at the end of the 4- and 8-h dialysis sessions compared to the pre-dialysis values

Basile et al, NDT, 26:1296-1303; 2011

REMOVAL OF PROTEIN BOUND SOLUTES WITH LONG VS. STANDARD DIALYSIS IS NOT DIFFERENT

	RR 4 h (%)	RR 8 h (%)	% increase (8 h vs 4 h)	P[a]
Urea	69.3 (4.9)	74.6 (4.8)	7.6	< 0.0004
Creatinine	62.7 (6.7)	65.9 (5.7)	5.1	< 0.03
Uric acid	75.8 (6.4)	79.9 (5.3)	5.4	< 0.002
Phosphorus	40.9 (12.5)	50.7 (13.8)	23.9	< 0.01
β_2M	58.9 (8.4)	65.3 (8.3)	10.9	< 0.01
Homocysteine	45 (22.2)	51 (15.8)	13.3	**0.185**
Hippuric acid	53.3 (10.4)	57 (13.5)	7.5	**0.428**
Indole-3-acetic acid	44.7 (9.4)	46.5 (11.3)	4.9	**0.651**
Indoxyl sulphate	61.4 (17.0)	71.5 (19.6)	16.3	**0.102**

Means (SD).
[a]Student's *t*-test for unpaired data.

Table 5 Reduction ratios (RRs) at the end of the 4- and 8-h dialysis sessions compared to the pre-dialysis values

Basile et al, NDT, 26:1296-1303; 2011

REMOVAL OF PROTEIN BOUND SOLUTES WITH LONG VS. STANDARD DIALYSIS IS NOT DIFFERENT

	RR 4 h (%)	RR 8 h (%)	% increase (8 h vs 4 h)	P[a]
Urea	69.3 (4.9)	74.6 (4.8)	7.6	< 0.0004
Creatinine	62.7 (6.7)	65.9 (5.7)	5.1	< 0.03
Uric acid	75.8 (6.4)	79.9 (5.3)	5.4	< 0.002
Phosphorus	40.9 (12.5)	50.7 (13.8)	23.9	< 0.01
β_2M	58.9 (8.4)	65.3 (8.3)	10.9	< 0.01
Homocysteine	45 (22.2)	51 (15.8)	**13.3**	0.185
Hippuric acid	53.3 (10.4)	57 (13.5)	7.5	0.428
Indole-3-acetic acid	44.7 (9.4)	46.5 (11.3)	4.9	0.651
Indoxyl sulphate	61.4 (17.0)	71.5 (19.6)	**16.3**	0.102

Means (SD).
[a]Student's *t*-test for unpaired data.

Table 5 Reduction ratios (RRs) at the end of the 4- and 8-h dialysis sessions compared to the pre-dialysis values

Basile et al, NDT, 26:1296-1303; 2011

UREMIC SOLUTE KINETICS HAS A MAJOR IMPACT ON THEIR REMOVAL

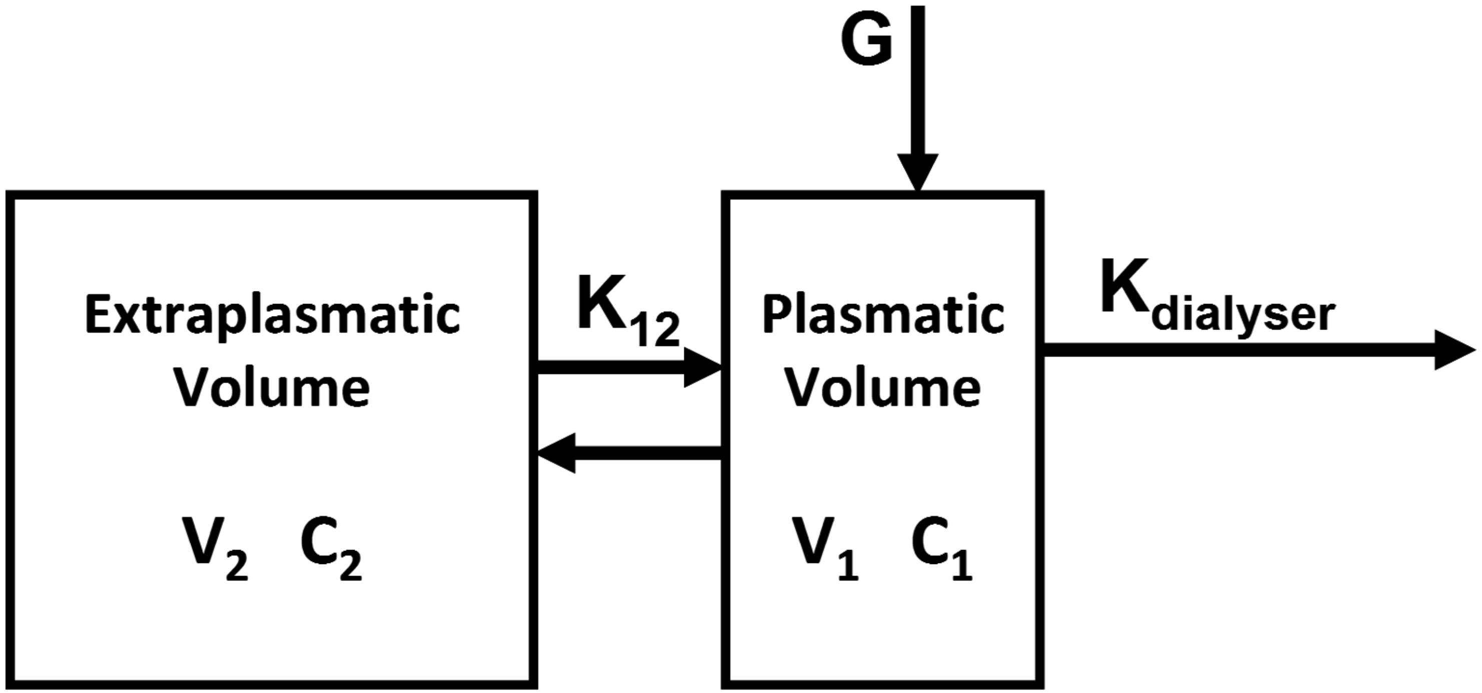


FIGURE 1: Two-compartment kinetic model. V_1: plasmatic volume, V_2: extraplasmatic volume, C_1: plasmatic concentration, C_2: extraplasmatic concentration, K: dialyzer clearance, K_{12}: intercompartment clearance, G: solute generation.

Eloot et al, submitted

UREMIC SOLUTE KINETICS HAS A MAJOR IMPACT ON THEIR REMOVAL

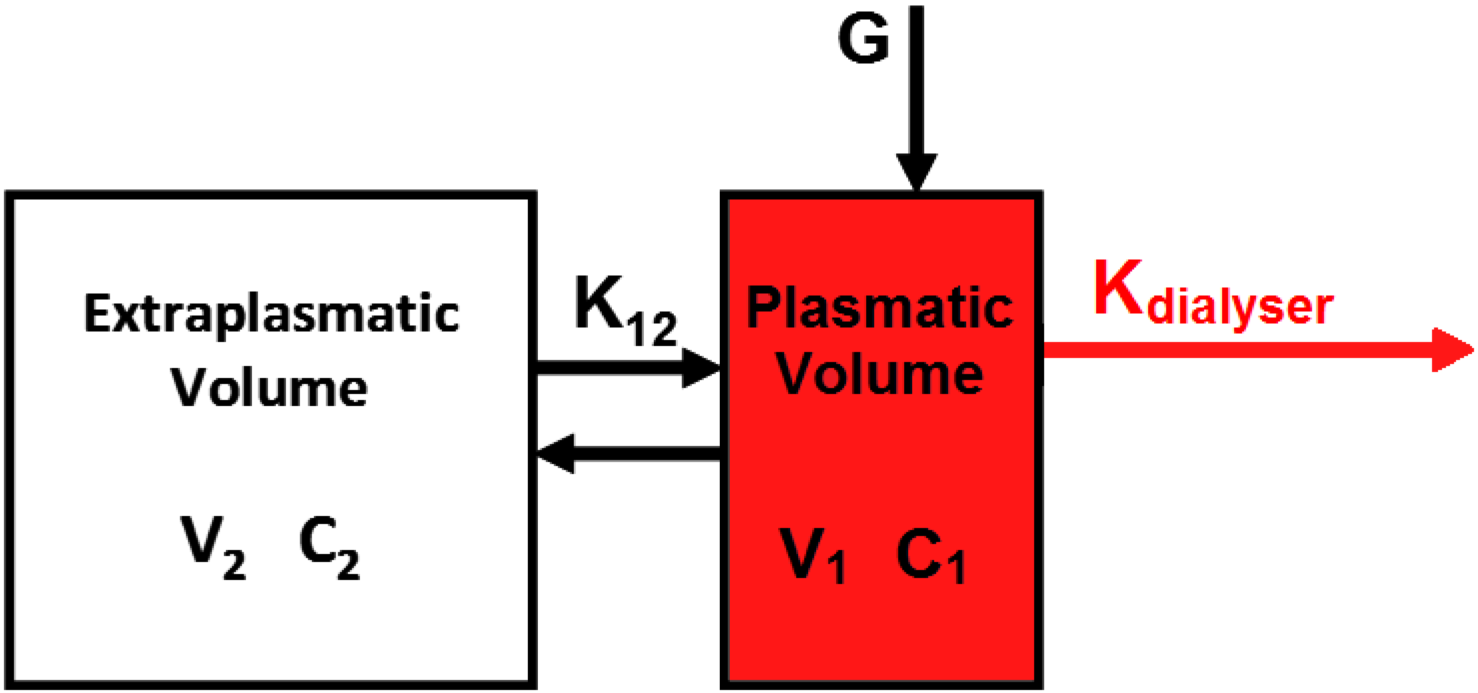


FIGURE 1: Two-compartment kinetic model. V_1: plasmatic volume, V_2: extraplasmatic volume, C_1: plasmatic concentration, C_2: extraplasmatic concentration, K: dialyzer clearance, K_{12}: intercompartment clearance, G: solute generation.

Eloot et al, submitted

UREMIC SOLUTE KINETICS HAS A MAJOR IMPACT ON THEIR REMOVAL

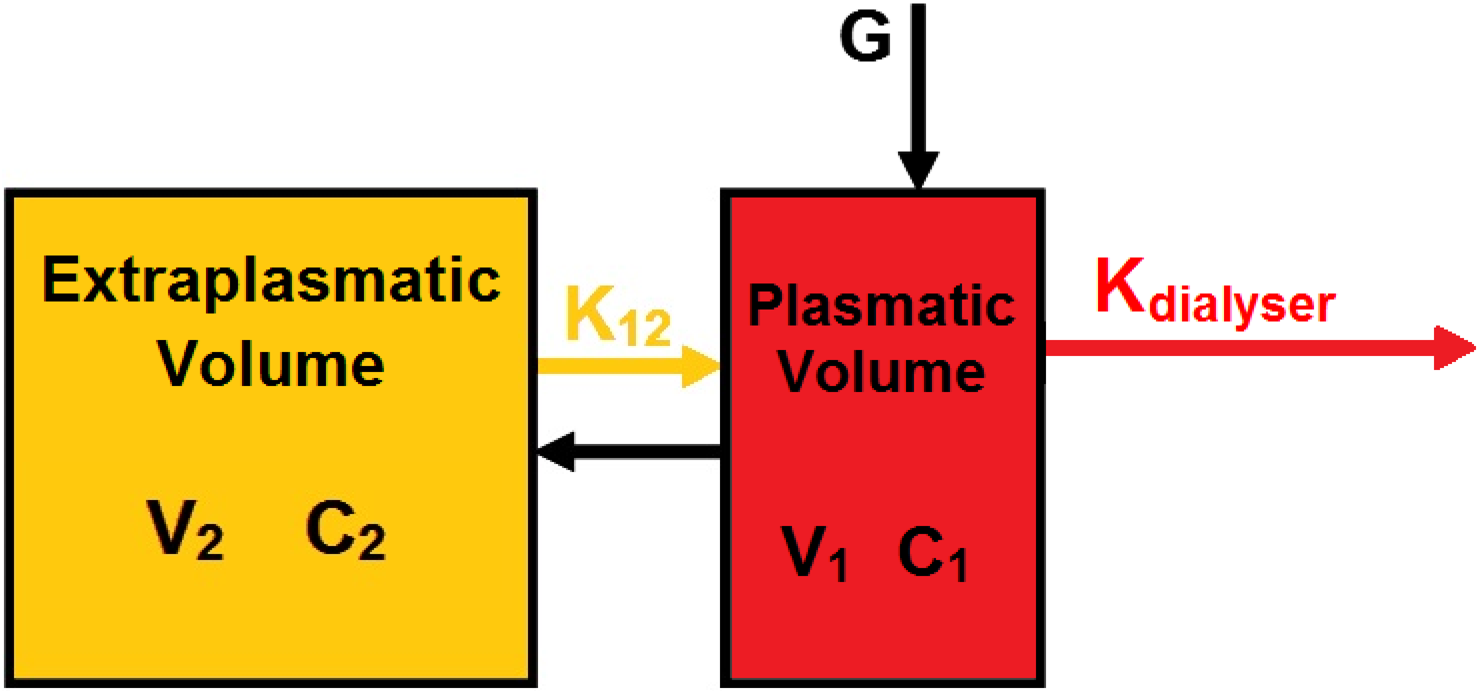


FIGURE 1: Two-compartment kinetic model. V_1: plasmatic volume, V_2: extraplasmatic volume, C_1: plasmatic concentration, C_2: extraplasmatic concentration, K: dialyzer clearance, K_{12}: intercompartment clearance, G: solute generation.

Eloot et al, submitted

UREMIC SOLUTE KINETICS HAS A MAJOR IMPACT ON THEIR REMOVAL

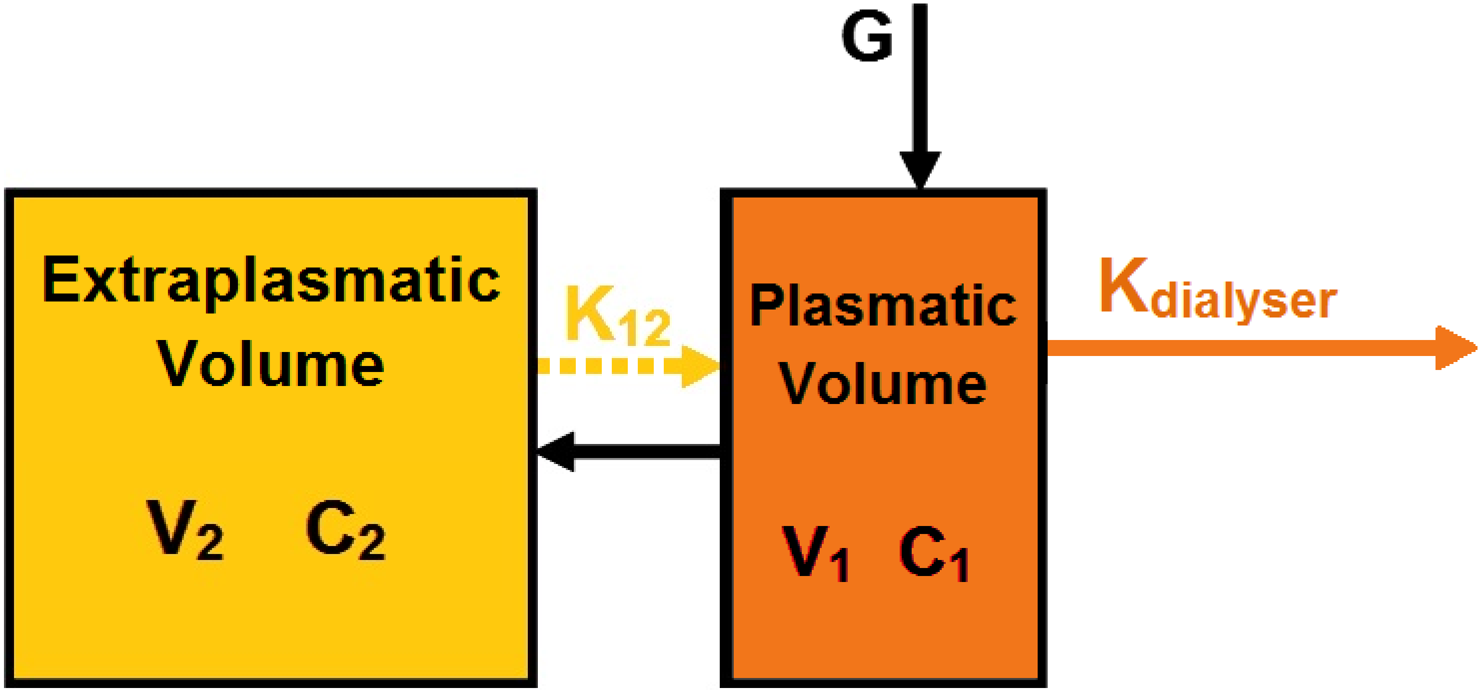


FIGURE 1: Two-compartment kinetic model. V_1: plasmatic volume, V_2: extraplasmatic volume, C_1: plasmatic concentration, C_2: extraplasmatic concentration, K: dialyzer clearance, K_{12}: intercompartment clearance, G: solute generation.

Eloot et al, submitted

UREMIC SOLUTE KINETICS HAS A MAJOR IMPACT ON THEIR REMOVAL

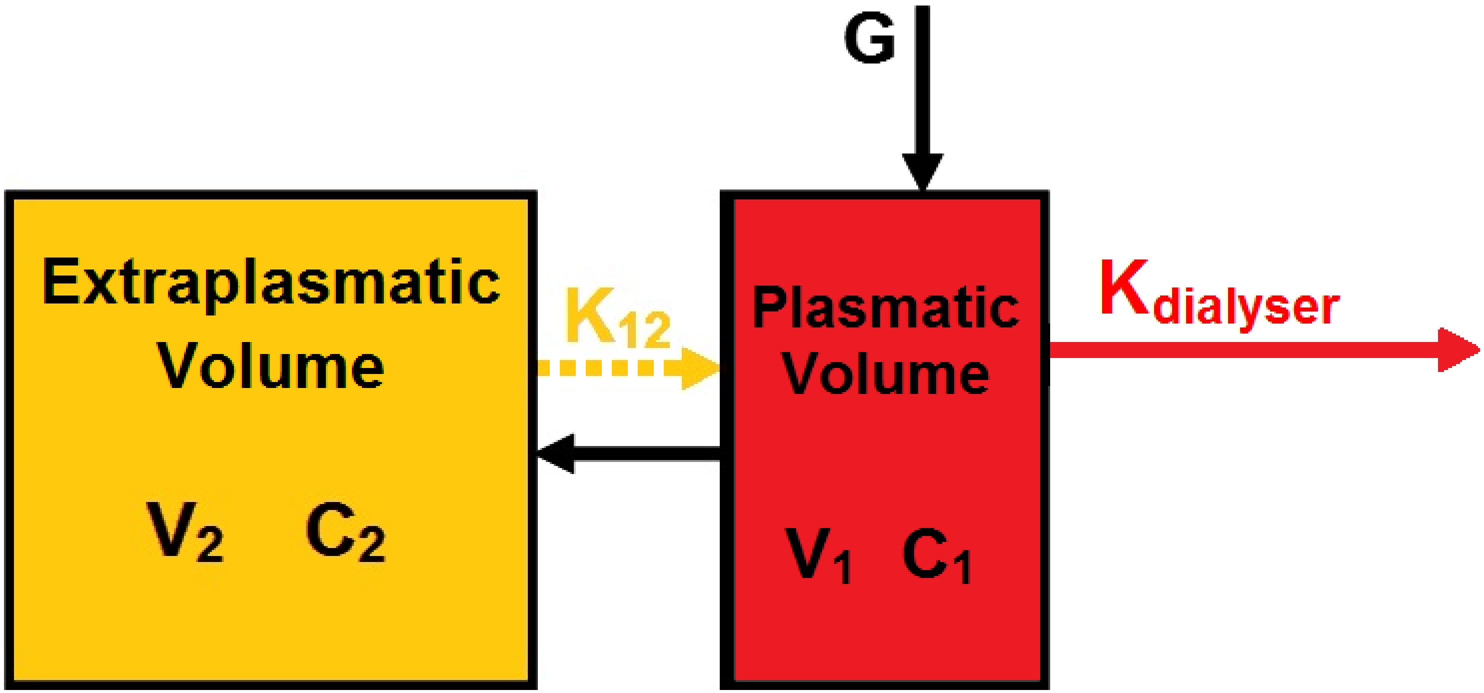


FIGURE 1: Two-compartment kinetic model. V_1: plasmatic volume, V_2: extraplasmatic volume, C_1: plasmatic concentration, C_2: extraplasmatic concentration, K: dialyzer clearance, K_{12}: intercompartment clearance, G: solute generation.

Eloot et al, submitted

UREMIC SOLUTE KINETICS HAS A MAJOR IMPACT ON THEIR REMOVAL

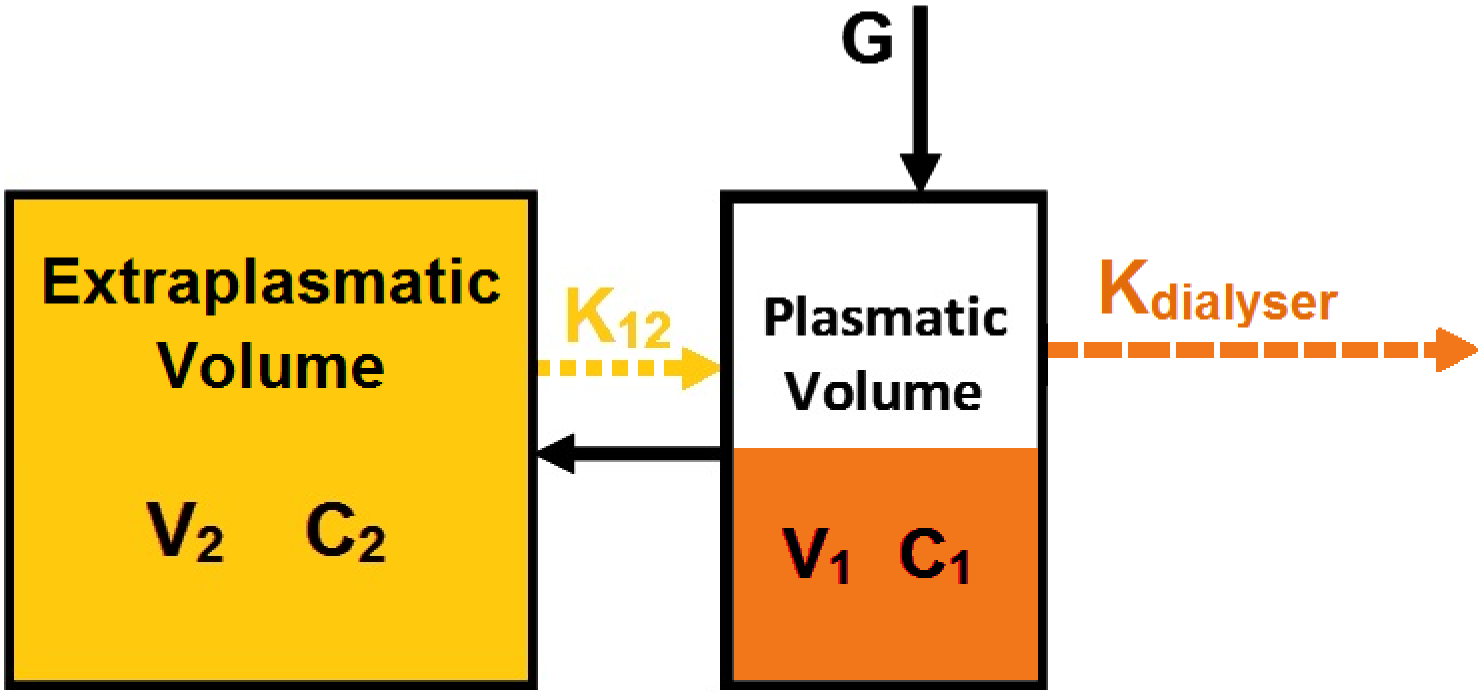
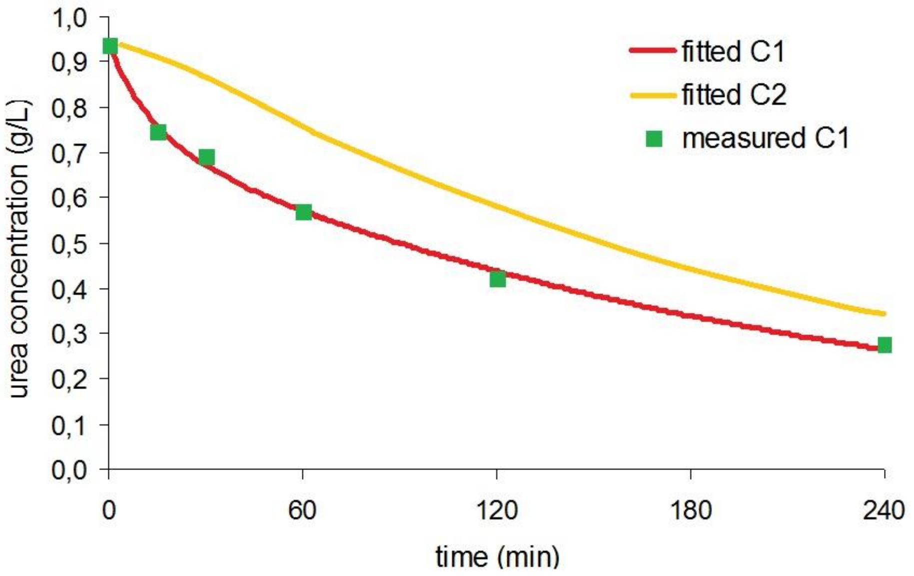


FIGURE 1: Two-compartment kinetic model. V_1: plasmatic volume, V_2: extraplasmatic volume, C_1: plasmatic concentration, C_2: extraplasmatic concentration, K: dialyzer clearance, K_{12}: intercompartment clearance, G: solute generation.

Eloot et al, submitted

WITH REFRAINED INTERCIMPARTMENTAL SHIFTS EXTRAPLASMATIC REMOVAL LAGS BEHIND

Fig. 2 A: Urea



Eloot et al, submitted

WITH REFRAINED INTERCIMPARTMENTAL SHIFTS EXTRAPLASMATIC REMOVAL LAGS BEHIND

Fig. 2 A: Urea

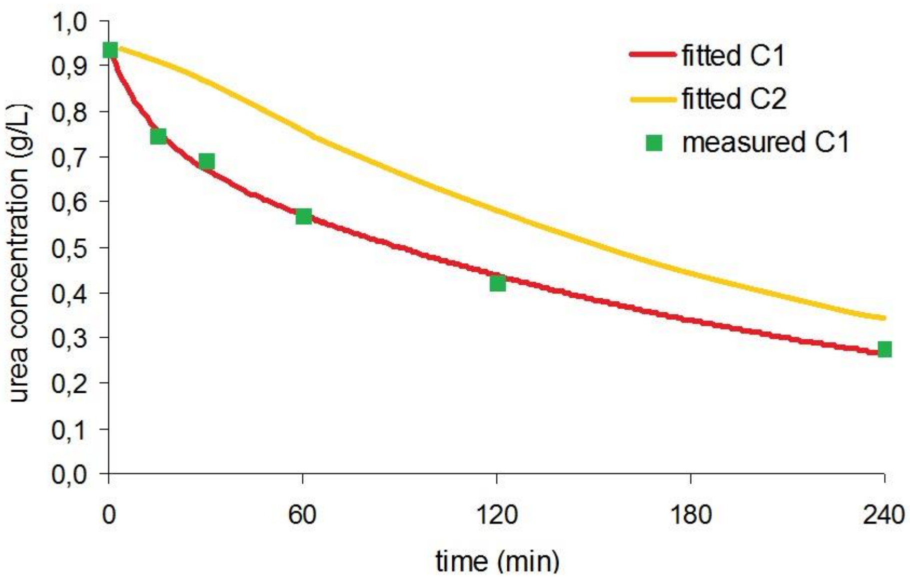
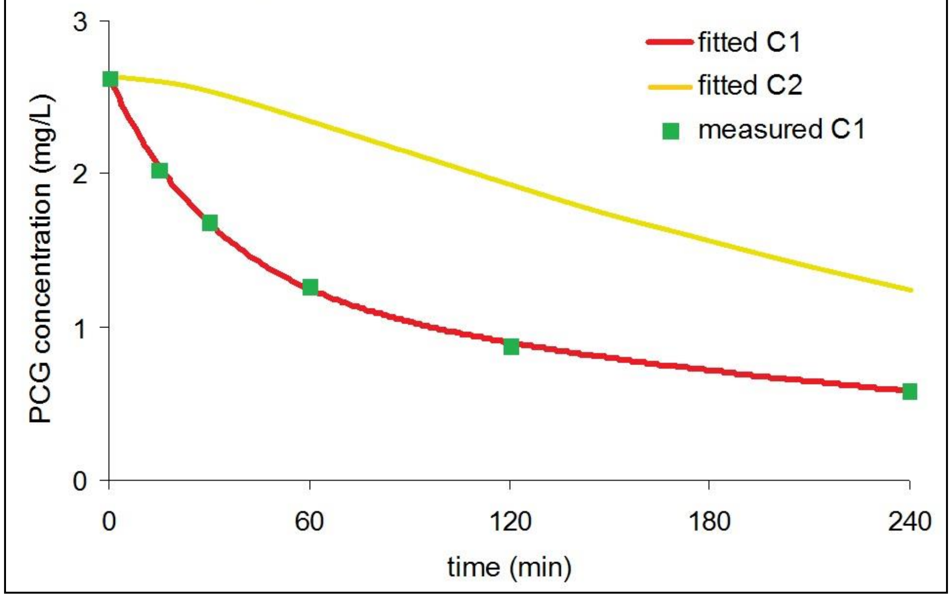


Fig. 2 B: P-cresylglucuronide



Eloot et al, submitted

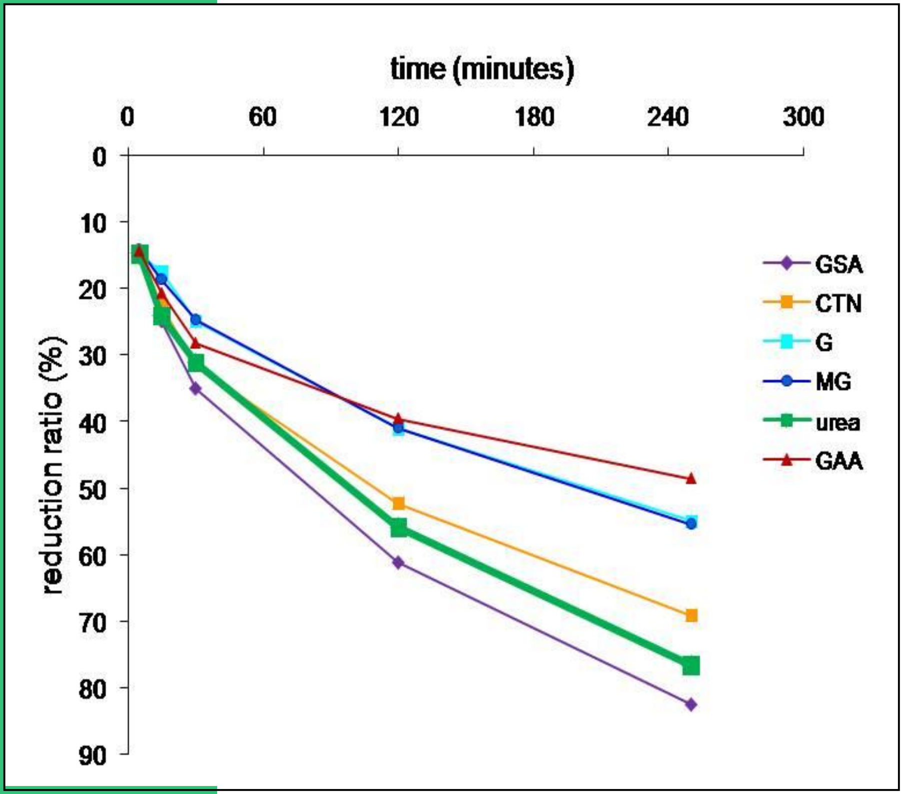
COMPARTMENTALISATION GUANIDINES

Compound	V	Eff Rem
Urea	42.7±6.0	67±4
Creatine	98.0±52.3*	42±16*
Creatinine	54.0±5.9*	58±6*
Guanidino acetic acid	123.8±66.9*	37±14*
Guanidine	89.7±21.4*	43±7*
Methylguanidine	102.6±33.9*	42±12*

*: $p<0.05$; V: distribution volume (L); Eff Rem: effective removal (%)

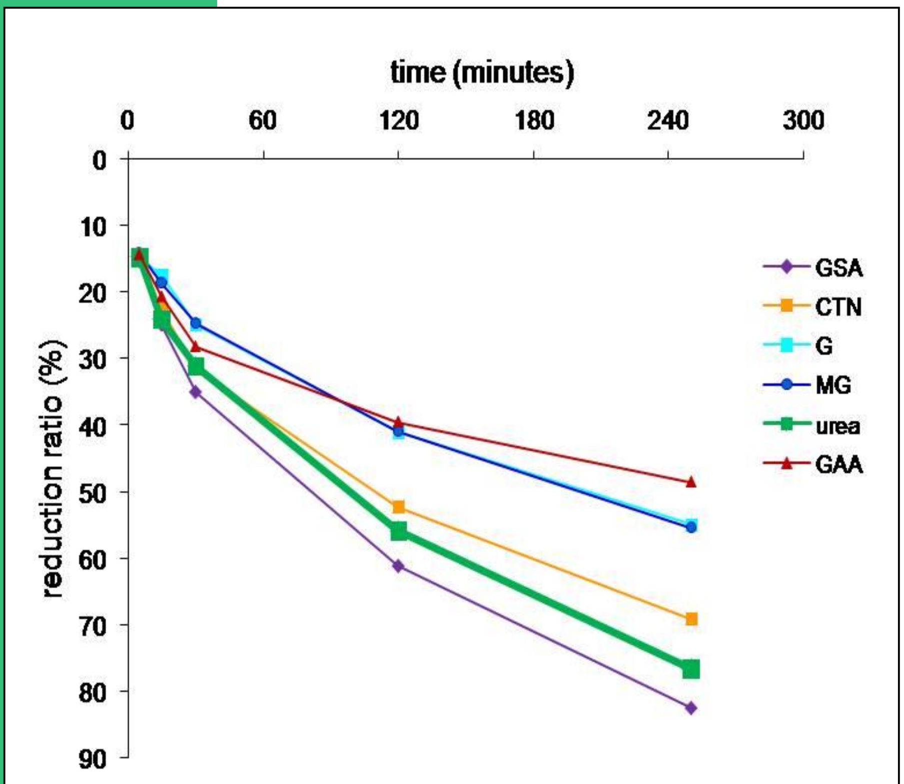
Eloot et al, KI, 67: 1566-1575; 2005

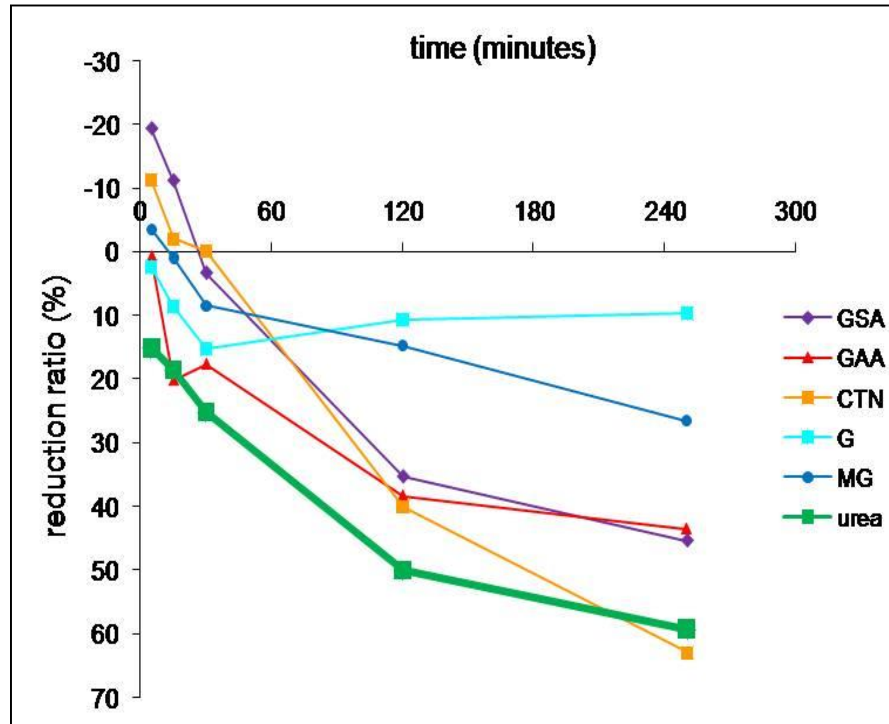
COMPARTMENTALISATION GUANIDINES



Eloot et al, AJKD, 50: 279; 2007

COMPARTMENTALISATION GUANIDINES





Eloot et al, AJKD, 50: 279; 2007

IMPACT ON REMOVAL AND OUTCOME OF EXTENDED ALTERNATE DAY DIALYSIS

Table 2 | Effect of long thrice-weekly haemodialysis

Parameter	Type of study	Effect	References
Removal			
Urea	Two randomized crossover trials	Improvement	Eloot *et al.* (2008);[25] Basile *et al.* (2011)[95]
Creatinine	Two randomized crossover trials	Improvement	Eloot *et al.* (2008);[25] Basile *et al.* (2011)[95]
Phosphate	Two randomized crossover trials, two follow-up studies	Improvement	Eloot *et al.* (2008);[25] Haag-Weber (2003);[93] Alloatti *et al.* (2002);[94] Basile *et al.* (2011)[95]
β_2-microglobulin	Two randomized crossover trials	Improvement	Eloot *et al.* (2008);[25] Basile *et al.* (2011)[95]
Kt/V_{urea}	Two randomized crossover trials	No difference	Eloot *et al.* (2008);[25] Basile *et al.* (2011)[95]
Protein-bound solutes	Randomized crossover trial	No difference	Basile *et al.* (2011)[95]
Outcome			
Survival	One comparison of two units with different strategies, one observational cohort study	Improvement	Innes *et al.* (1999);[96] Lockridge *et al.* (2009)[97]
Quality of life	Randomized crossover trial	Improvement	McGregor *et al.* (2001)[98]
Intradialytic haemodynamic stability	Literature review	Improvement	Charra *et al.* (2003)[99]
Blood pressure control	Two follow-up studies, one randomized crossover study, two cross-sectional cohort studies, one literature review	Improvement	Haag-Weber (2003);[93] Alloatti *et al.* (2002);[94] McGregor *et al.* (2001);[98] Charra *et al.* (2003);[99] McGregor (1999);[100] Chazot (1995)[101]
ESA need	Two follow-up studies	Improvement	Haag-Weber (2003);[93] Alloatti *et al.* (2002)[94]
Body weight	Follow-up study	Improvement	Alloatti *et al.* (2002)[94]
Sympathetic activity	Randomized crossover trial	Improvement	McGregor *et al.* (2001)[98]
Parasympathetic activity	Randomized crossover trial	Improvement	McGregor *et al.* (2001)[98]
Burden on social life	Randomized crossover trial	Improvement	McGregor *et al.* (2001)[98]
Arterial stiffness	Prospective matched control study	Improvement	Demirci *et al.* (2012)[102]
Cardiovascular morbidity	Retrospective comparison, case–control study	Improvement	Flythe *et al.* (2011);[103] Ok *et al.* (2011)[104]
Cardiovascular mortality	Retrospective comparison, case–control study	Improvement	Ok *et al.* (2011);[103] Ok *et al.* (2011)[104]

Abbreviation: ESA, erythropoiesis-stimulating agent.

Vanholder et al, Nat Rev Nephrol, 8:579-588; 2012

IMPACT OF ULTRAFILTRATION RATE ON CARDIOVASCULAR MORTALITY

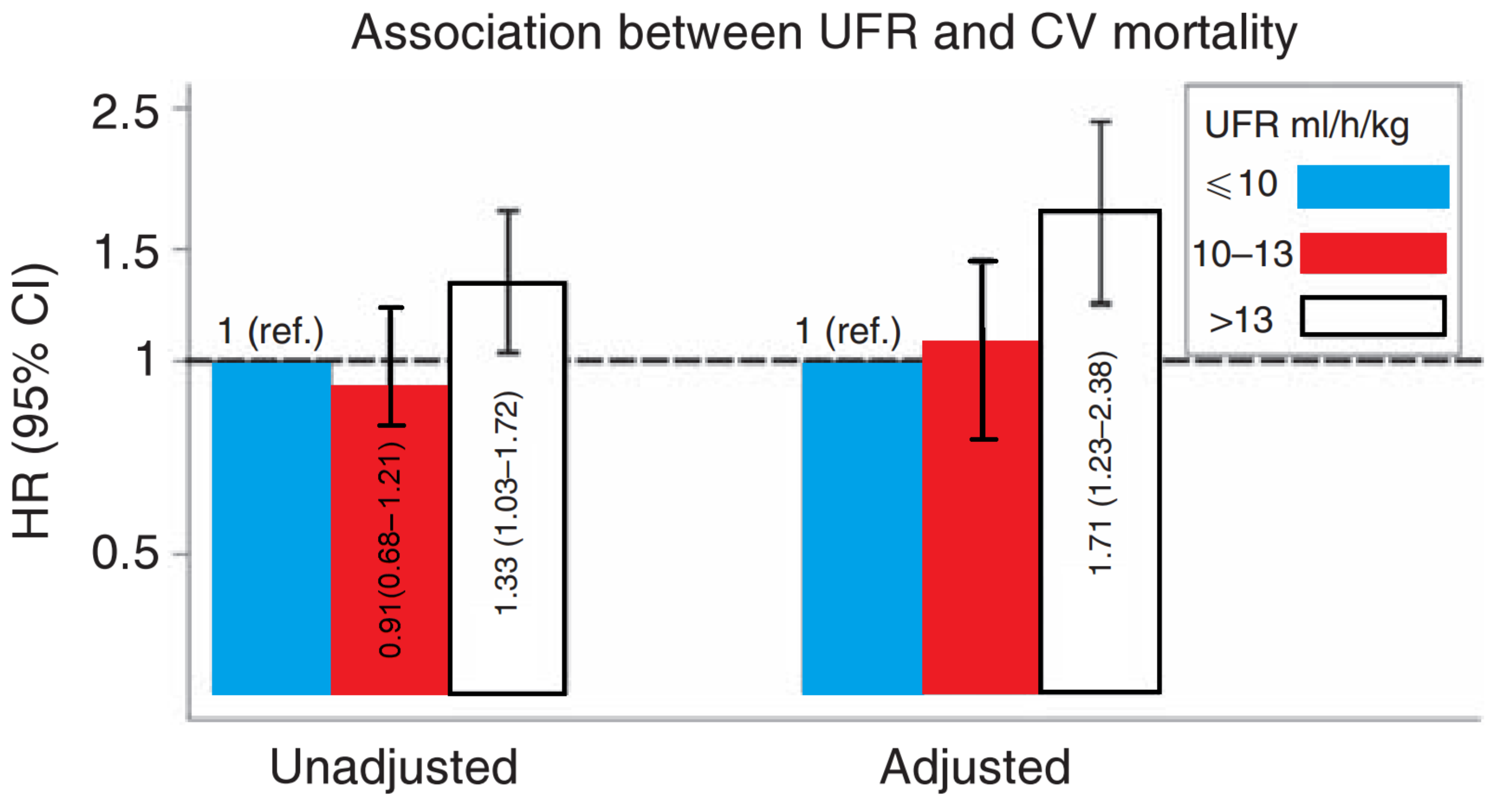


Fig. 2 - Unadjusted and adjusted associations between ultrafiltration rate (UFR) and cardiovascular (CV)-related mortality based on Cox regression models.

Flythe et al, KI, 79:250-257; 2011

IMPACT OF DIALYSIS LENGTH ON MORTALITY

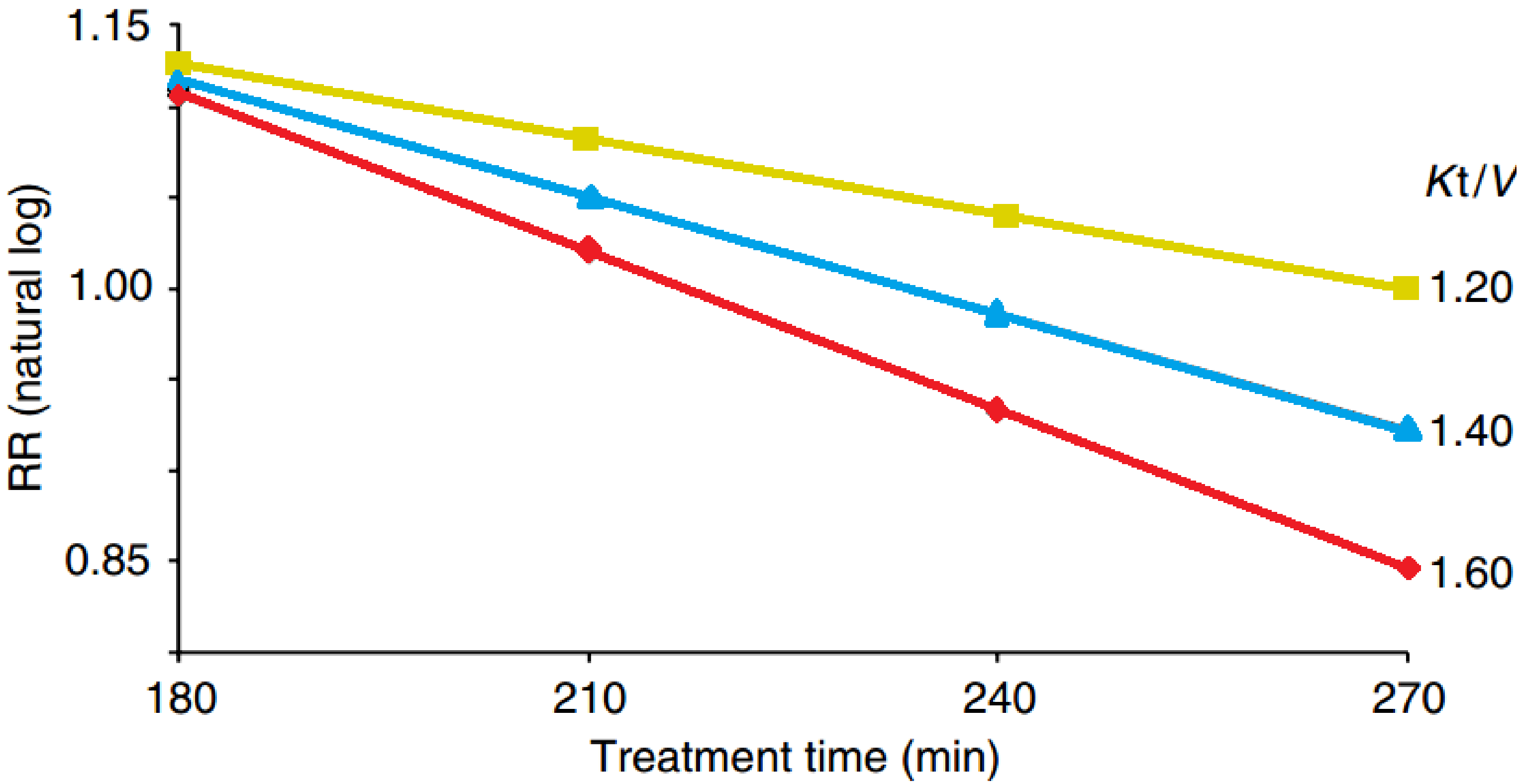
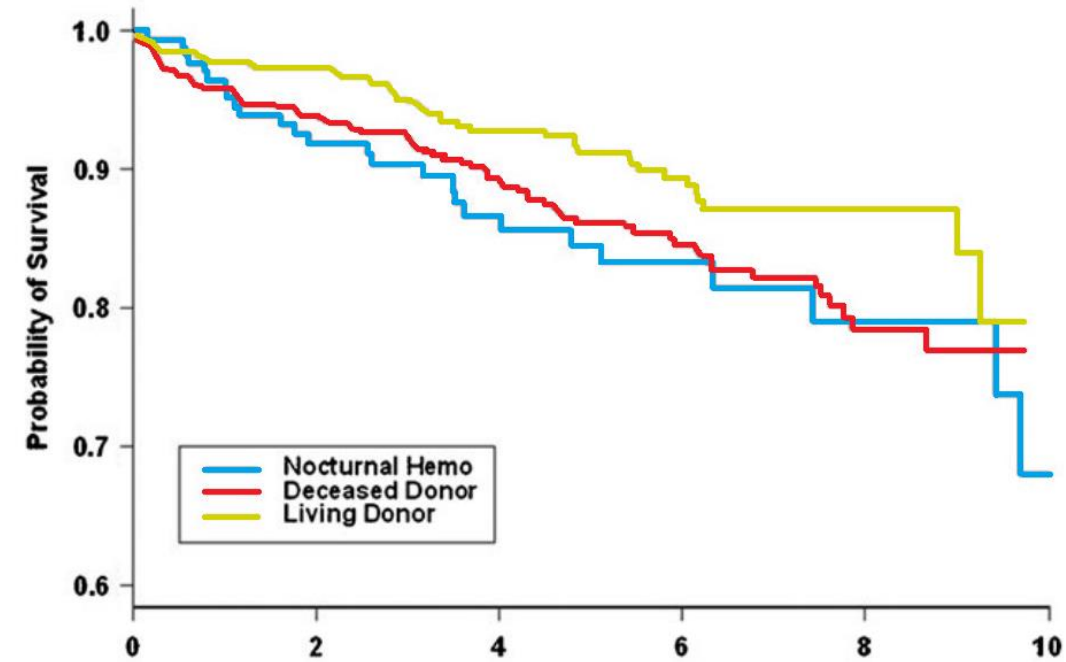


Fig. 4 - Interaction between *Kt*/*V* and TT.

Saran et al, KI, 69:1222-1228; 2006

EFFECT OF EXTENDED DAILY DIALYSIS ON SURVIVAL



N						
NHD	177	134	85	48	28	10
DTX	531	463	302	198	90	0
LTX	531	458	282	170	60	0

Time to death in patients treated with nocturnal haemodialysis, deceased and living donor kidney transplantation (log-rank test, *P* = 0.03).

Pauly et al, NDT, 24: 2915-2919; 2009

IMPACT ON REMOVAL AND OUTCOME OF EXTENDED DAILY DIALYSIS

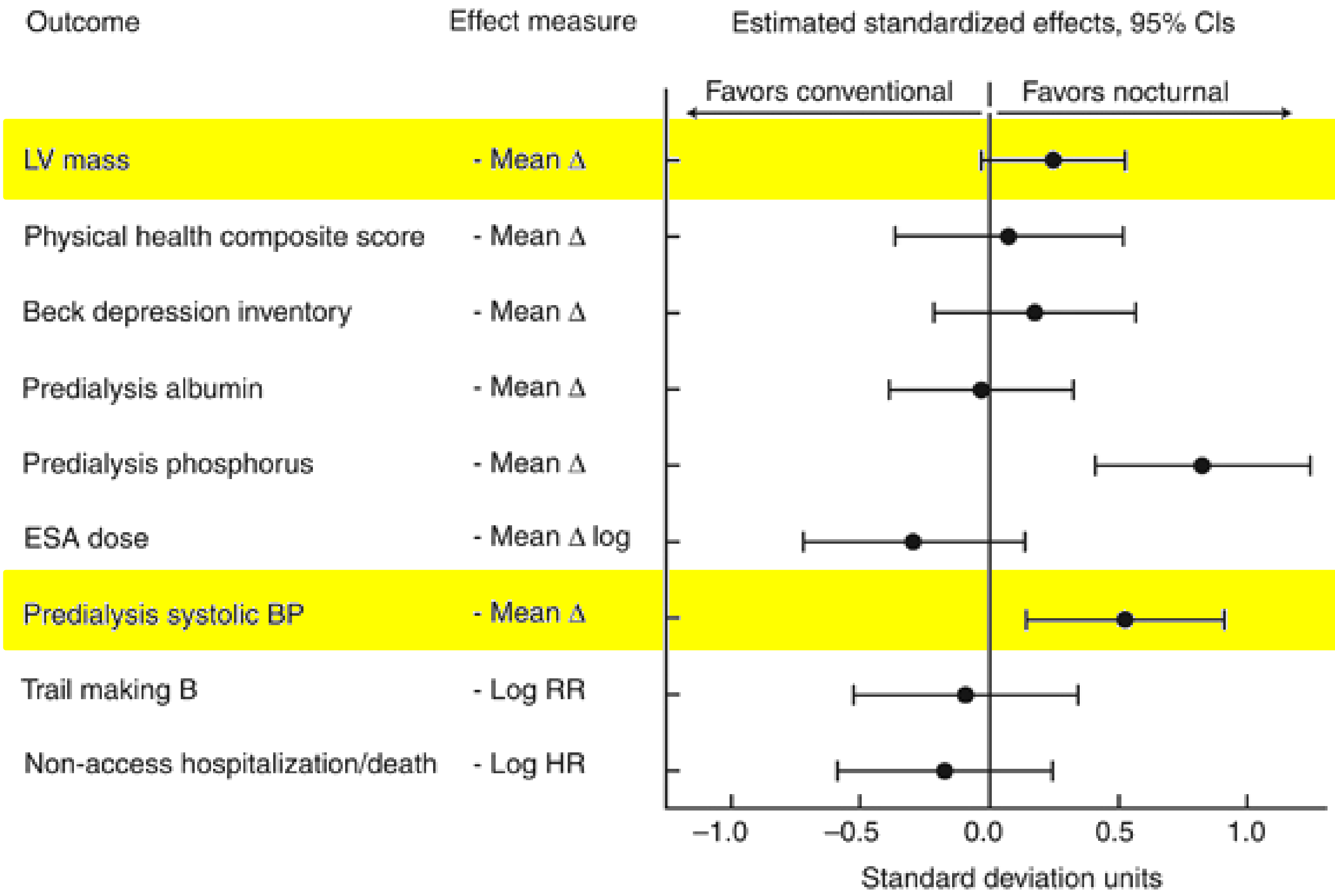
Table 3 | Impact of long frequent haemodialysis

Parameter	Type of study	Effect	References
Removal			
Hyperphosphataemia	Two RCTs, one case study, one follow-up study	Improvement	Rocco *et al.* (2011);[89] Walsh *et al.* (2010);[105] Mucsi *et al.* (1998);[107] Chan *et al.* (2003)[108]
Predialysis urea	RCT	Improvement	Rocco *et al.* (2011)[89]
Kt/V_{urea}	RCT	Improvement	Rocco *et al.* (2011)[89]
Guanidino compounds	Mathematical simulation	Improvement	Eloot *et al.* (2009)[73]
Outcome			
Apnoea, hypopnoea	Follow-up study	Improvement	Hanly *et al.* (2001)[109]
Plasma albumin	Follow-up study	Improvement	Wong *et al.* (2007)[110]
Haemoglobin	Follow-up study	Improvement	Wong *et al.* (2007)[110]
EPO need	Follow-up study	Improvement	Wong *et al.* (2007)[110]
Blood pressure	One RCT, one follow-up study	Improvement	Culleton *et al.* (2007);[106] Wong *et al.* (2007)[110]
Quality of life	One RCT, one questionnaire-based comparison	Improvement	Culleton *et al.* (2007);[106]; McFarlane *et al.* (2003)[111]
Myocardial stunning	Cross-sectional study	Improvement	Jefferies *et al.* (2011)[83]
LVM	RCT	Improvement	Culleton *et al.* (2007)[106]
Survival and improved LVM*	RCT	No difference	Rocco *et al.* (2011)[89]
Survival and improved QoL*	RCT	No difference	Rocco *et al.* (2011)[89]
Survival	Matched control study with cadaveric donor transplantation	No difference	Pauly *et al.* (2009)[112]
Survival	Matched control study with living donor transplantation	Worsening	Pauly *et al.* (2009)[112]
Blood pressure control	Systematic review	Improvement	Walsh *et al.* (2005)[113]
Survival	Systematic review	No difference	Walsh *et al.* (2005)[113]

*Composite end point. Abbreviations: EPO, erythropoietin; LVM, left ventricular mass; QoL, quality of life; RCT, randomized controlled trial.

Vanholder et al, Nat Rev Nephrol, 8:579-588; 2012

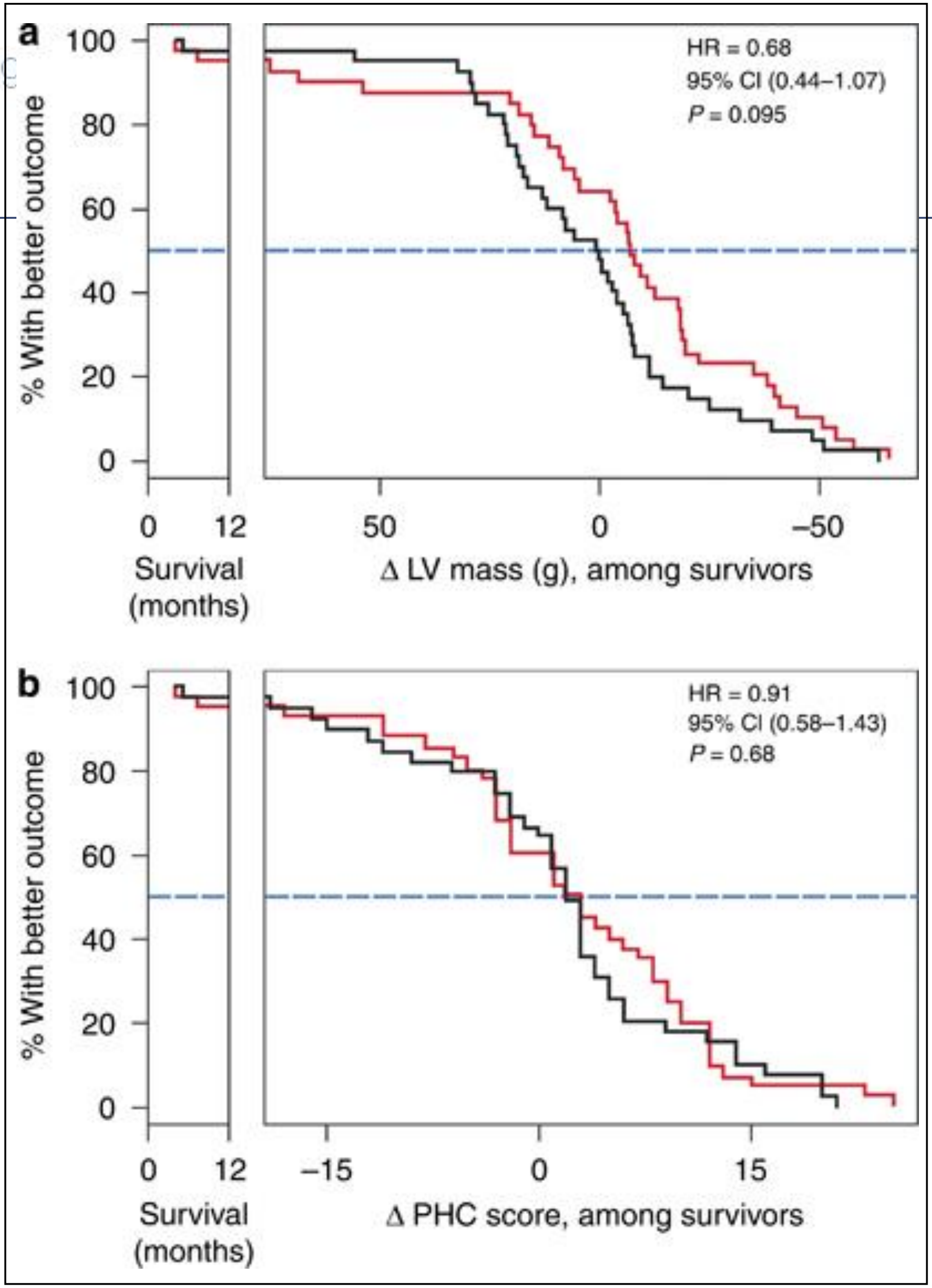
EFFECT OF EXTENDED DAILY DIALYSIS ON LV MASS AND SYSTOLIC BP



Rocco et al, KI, 80: 1080-1091; 2011

EFFECT OF EXTENDED DAILY DIALYSIS ON SURVIVAL

Fig. 3 - Mortality/LV mass composite and mortality/PHC composite results. Kaplan–Meier curves (conventional arm, black; frequent nocturnal arm, red) for the (**a**) death/LV mass composite and the (**b**) death/PHC composite. For any given value of the composite outcome indicated on the horizontal axis (time of death on the left, change in either LV mass or PHC among survivors on the right), the Kaplan–Meier curves indicate the proportion of patients in the respective treatment groups with an equal or more favorable outcome. The horizontal distance between the Kaplan–Meier curves at the 50% value on the vertical axis indicates the median composite outcome results. CI, confidence interval; HR, hazard ratio; LV, left ventricular; PHC, physical health composite.



Rocco et al, KI, 80: 1080-1091; 2011

EFFECT OF DAILY DIALYSIS ON ACCESS

Table 4. Adverse Events during the 12-Month Follow-up Period of the Study.*

Outcome	Conventional Hemodialysis (N=120)		Frequent Hemodialysis (N=125)		Hazard Ratio (95% CI)	P Value
	no. of events	*no. of patients with event*	*no. of events*	*no. of patients with event*		
Death	9		5		—	—
All hospitalizations	114	47	109	58	0.88 (0.60–1.28)	0.50
Unrelated to vascular access	90	44	79	47	0.80 (0.53–1.21)	0.30
Related to vascular access	24	14	30	20	0.99 (0.54–1.82)	0.97
Cardiovascular-related	15	12	17	15	0.83 (0.44–1.59)	—
Infection related	27	20	27	23	0.83 (0.49–1.40)	—
All interventions related to vascular access	65	29	95	47	1.35 (0.84–2.18)	0.22
Correction of access failure	23	15	19	15	0.71 (0.35–1.44)	0.35
Other procedures	42	21	76	38	1.71 (0.98–2.97)	0.06
Episodes of hypertension†	470	87	724	99	—	—
Hypokalemia						
Potassium <3.0 mmol/liter	0	0	0	0	—	—
Potassium <3.5 mmol/liter	6	5	13	8	—	0.57‡
Hypophosphatemia§	9	7	15	9	—	0.80‡

* The hazard ratios and P values for rates of events (including multiple events per patient) between the frequent-hemodialysis group and the conventional-hemodialysis group were calculated with the use of the Andersen–Gill model, except where otherwise noted.

† The percentage of dialysis treatments with recorded hypotensive episodes, defined as the need for a lower ultrafiltration rate, reduced blood flow, or saline administration to ameliorate hypotension, was 10.9% in the frequent-hemodialysis group and 13.6% in the conventional-hemodialysis group (P=0.04 with the use of generalized estimating equations).

‡ The P values for the comparison of the number of patients with at least one event of hypokalemia or hypophosphatemia were calculated with the use of Fisher's exact test.

§ Hypophosphatemia was defined as a phosphorus concentration of less than 2.17 mg per deciliter (0.7 mmol per liter).

Chertow et al, NEJM, 363: 2287-2300; 2010

EFFECT OF DAILY DIALYSIS ON ACCESS

Table 4. Adverse Events during the 12-Month Follow-up Period of the Study.*

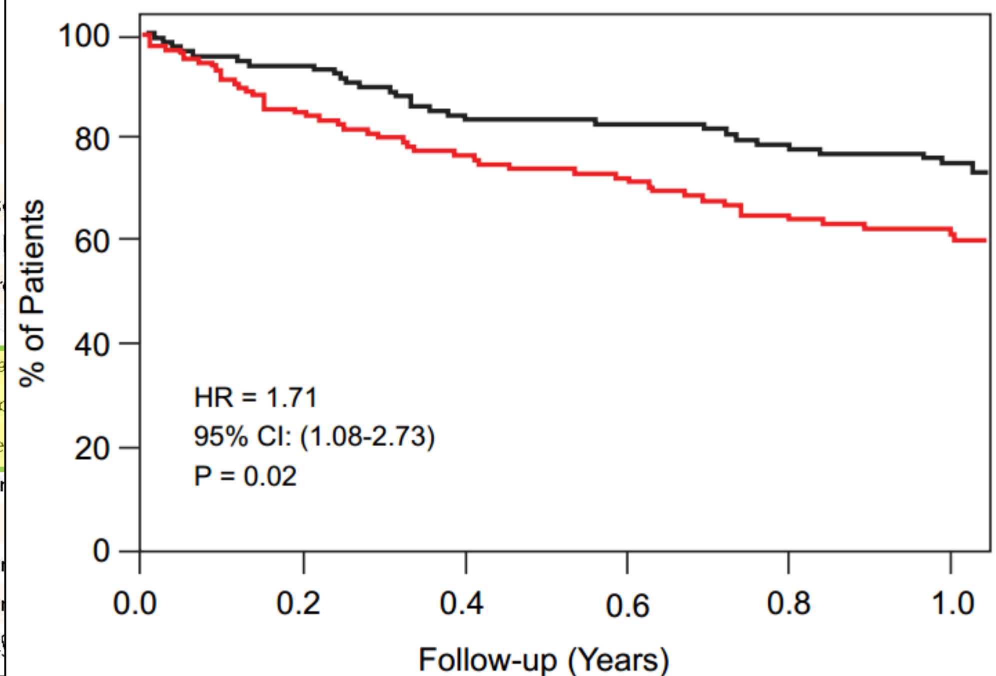
Outcome	…atio …l)	P Value
Death		—
All hospitalizations	1.28)	0.50
Unrelated to vas…	1.21)	0.30
Related to vascu…	1.82)	0.97
Cardiovascular-r…	1.59)	—
Infection related	1.40)	—
All interventions rela…	2.18)	0.22
Correction of acc…	1.44)	0.35
Other procedure…	2.97)	0.06
Episodes of hyperten…		—
Hypokalemia		
Potassium <3.0 …		—
Potassium <3.5 …		0.57‡
Hypophosphatemia§		0.80‡

* The hazard ratios ar… conventional-hemod… …s group and the

† The percentage of di… flow, or saline admi… hemodialysis group… …e, reduced blood …onventional-

‡ The P values for the… with the use of Fishe… …ere calculated

§ Hypophosphatemia…



Supplement Figure 4: Time to First Vascular Access Intervention

Shown are Kaplan-Meier curves in the 3 times per week (black) and 6 times per week (red) groups for the time from randomization to each patient's first access event. The hazard ratio was computed by Cox regression, with adjustment for diabetes, age, and clinical center. In months 0-3, 3-6, 6-9 and 9-12, there were 38, 19, 21 and 17 interventions in the 6 times per week arm and 20, 17, 12 and 16 in the 3 times per week arm, respectively.

Chertow et al, NEJM, 363: 2287-2300; 2010

EFFECT OF EXTENDED DAILY DIALYSIS ON RESIDUAL RENAL FUNCTION

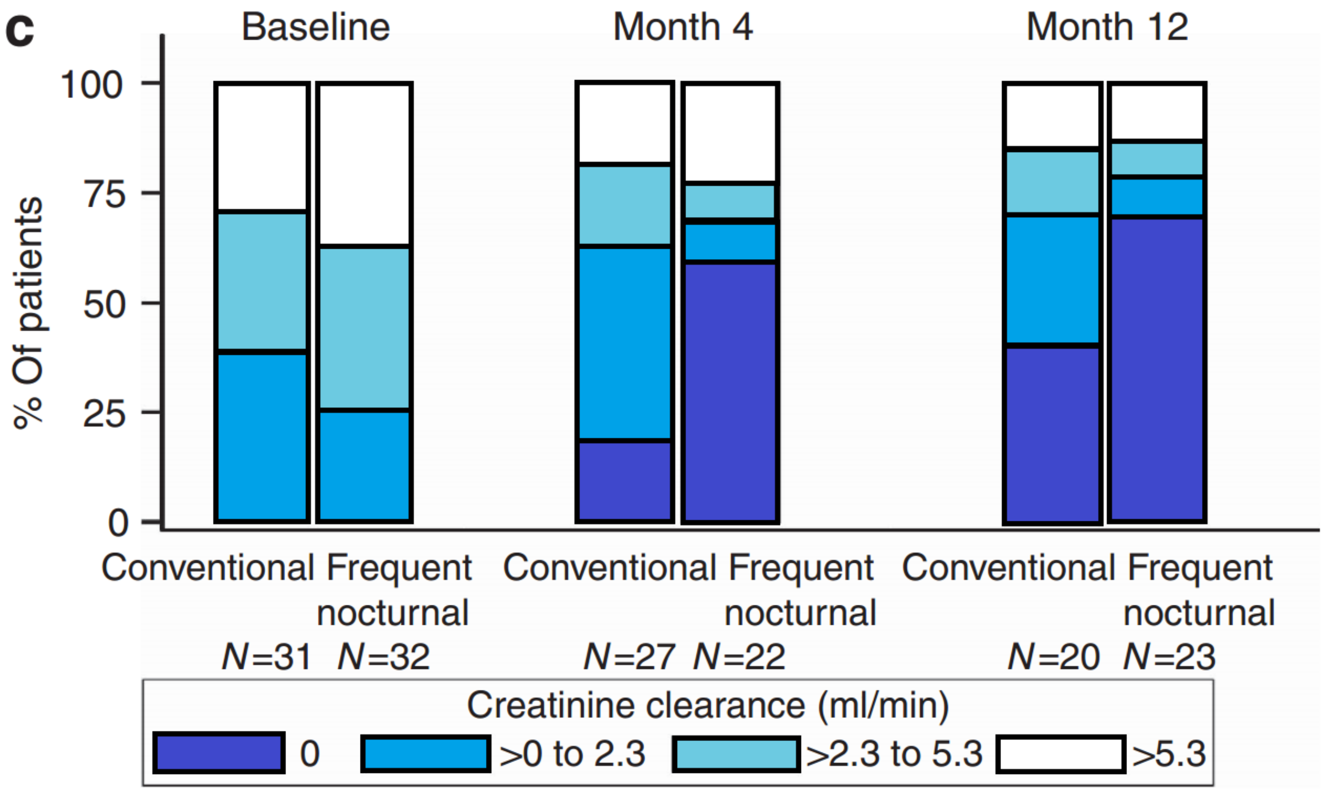


Fig. 2c - Nocturnal Trial subjects with baseline non-zero urine volume. Time course in the level of residual kidney function measured as (**c**) Krcreat, at baseline, month 4 and month 12.

Daugirdas et al, KI, doi:10.1038/ki.2012.457

CONCLUSIONS

- **Extended dialysis allows better removal of many uremic toxins, especially if they have more difficulties than urea to move out of the extraplasmatic compartment**

CONCLUSIONS

- **Extended dialysis allows better removal of many uremic toxins, especially if they have more difficulties than urea to move out of the extraplasmatic compartment**
- **This concerns B2-micorglobulin, phosphorus, the protein bound solutes and even small water soluble compounds like the guanidines**

CONCLUSIONS

- Extended dialysis allows better removal of many uremic toxins, especially if they have more difficulties than urea to move out of the extraplasmatic compartment
- This concerns B2-micorglobulin, phosphorus, the protein bound solutes and even small water soluble compounds like the guanidines
- In observational studies, extended dialysis is related to better survival

CONCLUSIONS

- Extended dialysis allows better removal of many uremic toxins, especially if they have more difficulties than urea to move out of the extraplasmatic compartment
- This concerns B2-micorglobulin, phosphorus, the protein bound solutes and even small water soluble compounds like the guanidines
- In observational studies, extended dialysis is related to better survival
- Frequent extended dialysis may affect vascular access and residual renal function

Universitair Ziekenhuis Gent

UNIVERSITEIT GENT

BACK-UPS

Nephrol Dial Transplant (2005) 20: 604–610
doi:10.1093/ndt/gfh674
Advance Access publication 21 January 2005

Nephrology Dialysis Transplantation

Original Article

Outcome of home haemodialysis patients: a case-cohort study

Esther Saner[1], Dorothea Nitsch[1], Claude Descoeudres[2], Felix J. Frey[1] and Dominik E. Uehlinger[1]

[1]Division of Nephrology/Hypertension, Inselspital, University of Bern and [2]Division of Nephrology, Salem-Spital Bern, Switzerland

Saner et al, NDT, 20:604-610; 2005

NESTED CASE-COHORT STUDY

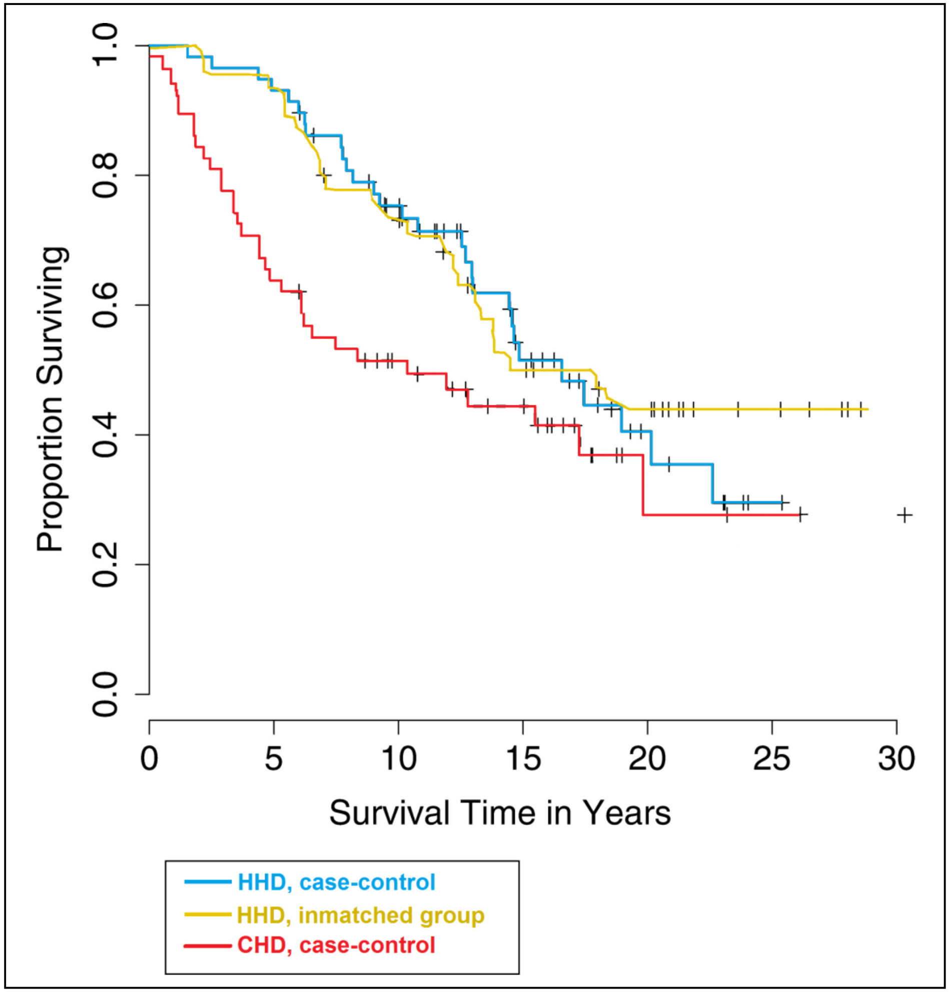
Table 1 - Basic patient characteristics at the start of haemodialysis treatment

	HHD	CHD
n	58	58
Male (%)	39 (67%)	39 (67%)
Married (%)	55 (84%)	41 (70%)
Year of dialysis onset (SD)	1983 (6.3)	1983 (6.6)
Age at dialysis onset (years) (SD)	50.1 (13.5)	50.6 (13.1)
Diabetes (%)	0 (0%)	1 (1.7%)
Smokers (%)	16 (27.6%)	20 (34.5%)
History of myocardial infarction (%)	3 (5.2%)	4 (6.9%)
History of cerebrovascular disease (%)	1 (1.7%)	3 (5.2%)
History of peripheral arterial disease (%)	2 (3.4%)	3 (5.2%)
Tuberculosis	3 (5.2%)	4 (6.9%)
COPD (%)	7 (12.1%)	7 (12.1%)
Khan comorbidity index		
Low risk	**50 (86%)**	**43 (74%)**
Medium risk	**3 (5%)**	**10 (17%)**
High risk	**5 (9%)**	**5 (9%)**

COPD, chronic obstructive pulmonary disease.

Saner et al, NDT, 20:604-610; 2005

NESTED CASE-COHORT STUDY



Saner et al, NDT, 20:604-610; 2005

AJKD
Original Investigation

Home Hemodialysis and Mortality Risk in Australian and New Zealand Populations

Mark R. Marshall, MBChB, MPH(Hons), FRACP,[1,2,3]
Carmel M. Hawley, MB,BS(Hons), MMedSci, FRACP,[4,5]
Peter G. Kerr, MB,BS, PhD, FRACP,[6,7]
Kevan R. Polkinghorne, BHB, MBChB, MClinEpi, PhD, FRACP,[6,7]
Roger J. Marshall, PhD,[1] John W.M. Agar, MB,BS, FRCP(Lond), FRACP,[3,8] and
Stephen P. McDonald, MB,BS(Hons), PhD, FRACP[3,9]

Marshall et al, AJKD , 58:782-793; 2011

metabole en cardiovasculaire aandoeningen

Universitair Ziekenhuis Gent

ADJUSTED MORTALITY

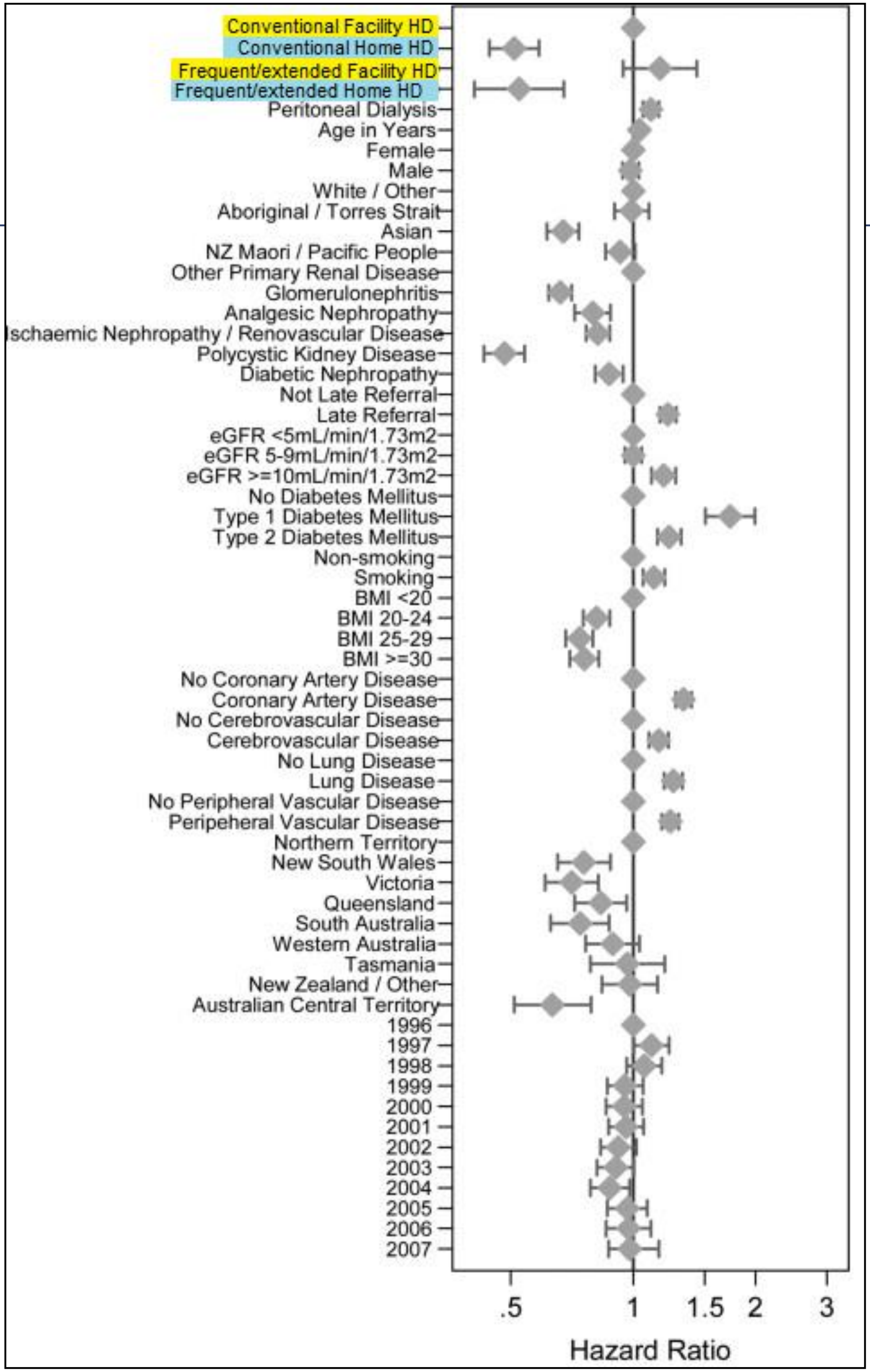


Figure 3

Hazard ratios for mortality from the main-effects marginal structural model using inverse probability of treatment and censoring weights, fully adjusted for the main-effects confounders listed in Table 2 (the marker represents point estimates, the whiskers, 95% confidence intervals). Abbreviations: BMI, body mass index; eGFR, estimated glomerular filtration rate; HD, hemodialysis; NZ, New Zealand.

Marshall et al, AJKD , 58:782-793; 2011

ADJUSTED MORTALITY

unclear. It is possible that our result arises from selection bias: healthier patients are selected for these modalities, treated in selected nephrology services with particular expertise.[7] This scenario is supported by 2 studies in the literature. Survival rates between home and facility HD were similar in unselected home HD patients[42] and also those with a high prevalence of diabetes mellitus.[43] In most studies, investigators have made only rudimentary statistical adjustments to minimize selection bias. More recently, a few have used more sophisticated multivariate regression and matching techniques.[29,33,35-37,39,41,44] There is no way of knowing whether these studies adjusted sufficiently for selection bias: from a pragmatic standpoint, none adjusted or matched for more than 5 covariates, which seems inadequate to account for such confounder imbalance. In our study, selection bias is minimized in 2 ways. First, the prevalence of home dialysis is much higher in Australia and New Zealand than in the United States and United Kingdom, diminishing selection bias at both the patient and center levels. Second, we have made extensive statistical adjustments for risk factors, as discussed.

Another explanation relates to higher socioeconomic status, which has been associated variably with lower mortality risk in dialysis populations.[45-47] Home HD patients tend to be employed with disposable income and adequate housing. The statistical interaction between ethnicity and mortality in our study supports a pivotal role for socioeconomic status in the better outcomes of home HD patients: the decrease in mortality risk associated with home HD is smaller in Aboriginal/Torres Strait Islanders and New Zealand Maori/Pacific people, subgroups known to be socioeconomically disadvantaged.[48]

787

Marshall et al, AJKD , 58:782-793; 2011

ARTICLE IN PRESS

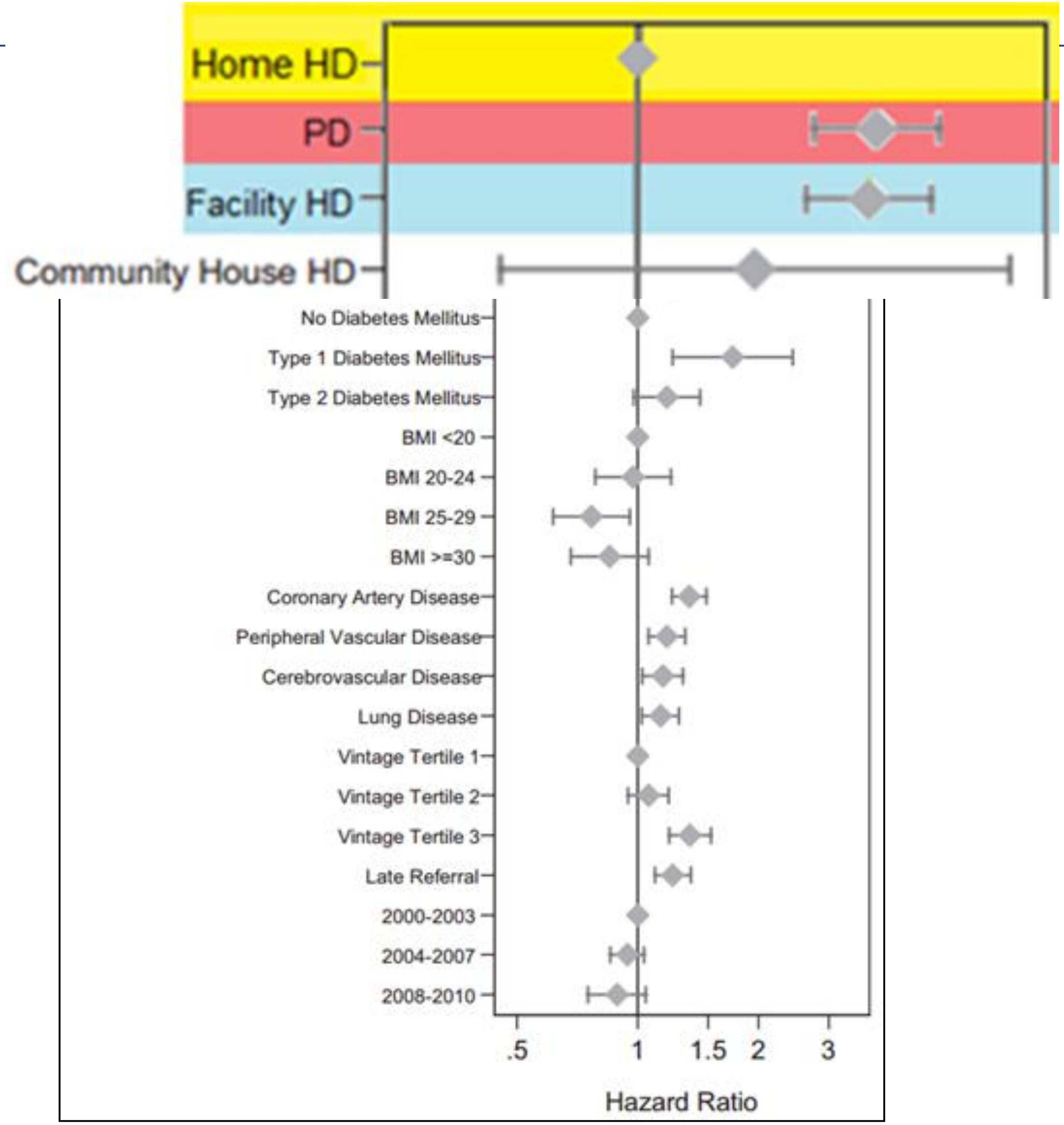
AJKD

Original Investigation

Independent Community House Hemodialysis as a Novel Dialysis Setting: An Observational Cohort Study

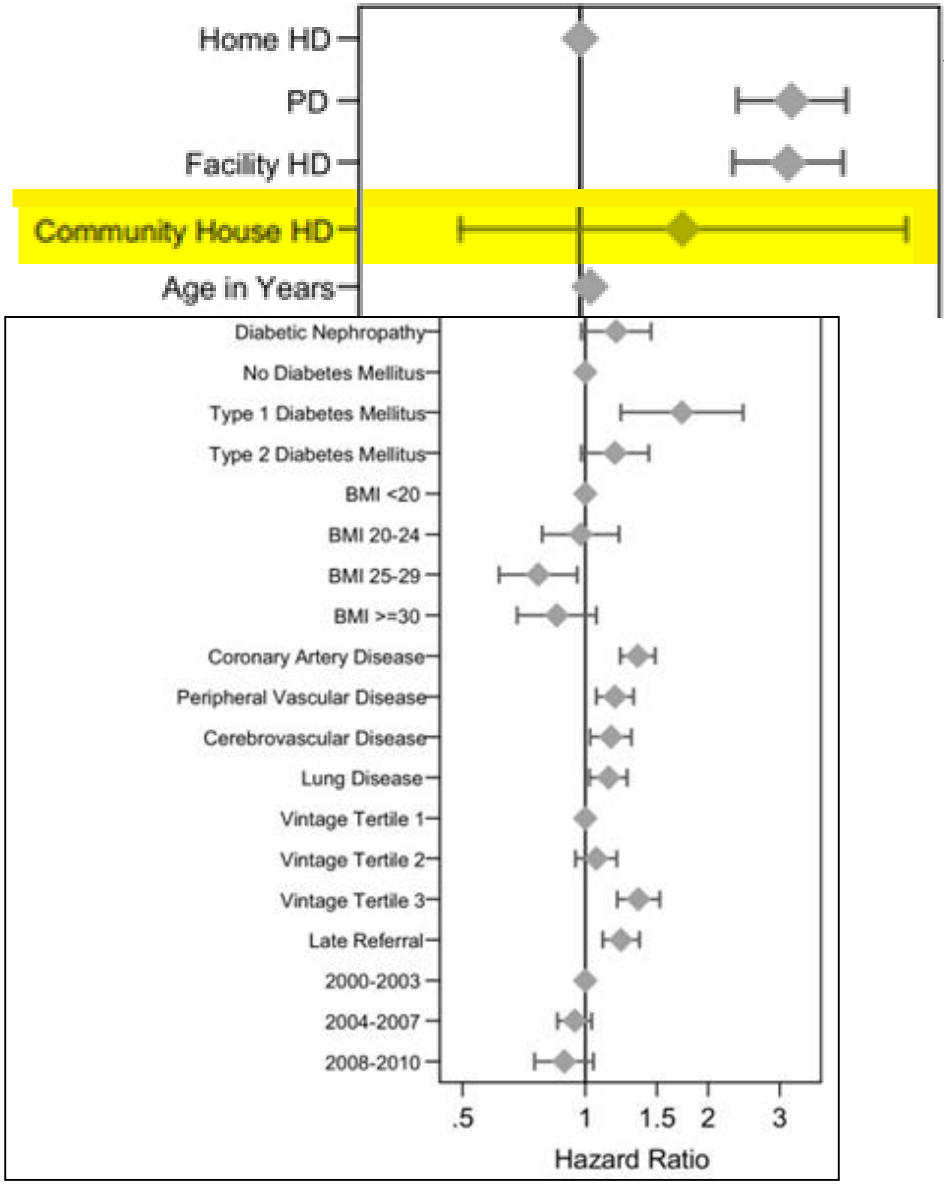
Mark R. Marshall, BHB, MBChB, FRACP, MPH (Hons),[1,2,3] Nora van der Schrieck,[4] David Lilley, BEM,[5] Sharen K. Supershad, MBBCh, FRACP,[6] Alvin Ng, MBChB, FRACP,[2] Rachael C. Walker, NP, RN, BN, MN,[7] and Joanna L. Dunlop, MBBS, BSc, FRACP[1,2]

MORTALITY



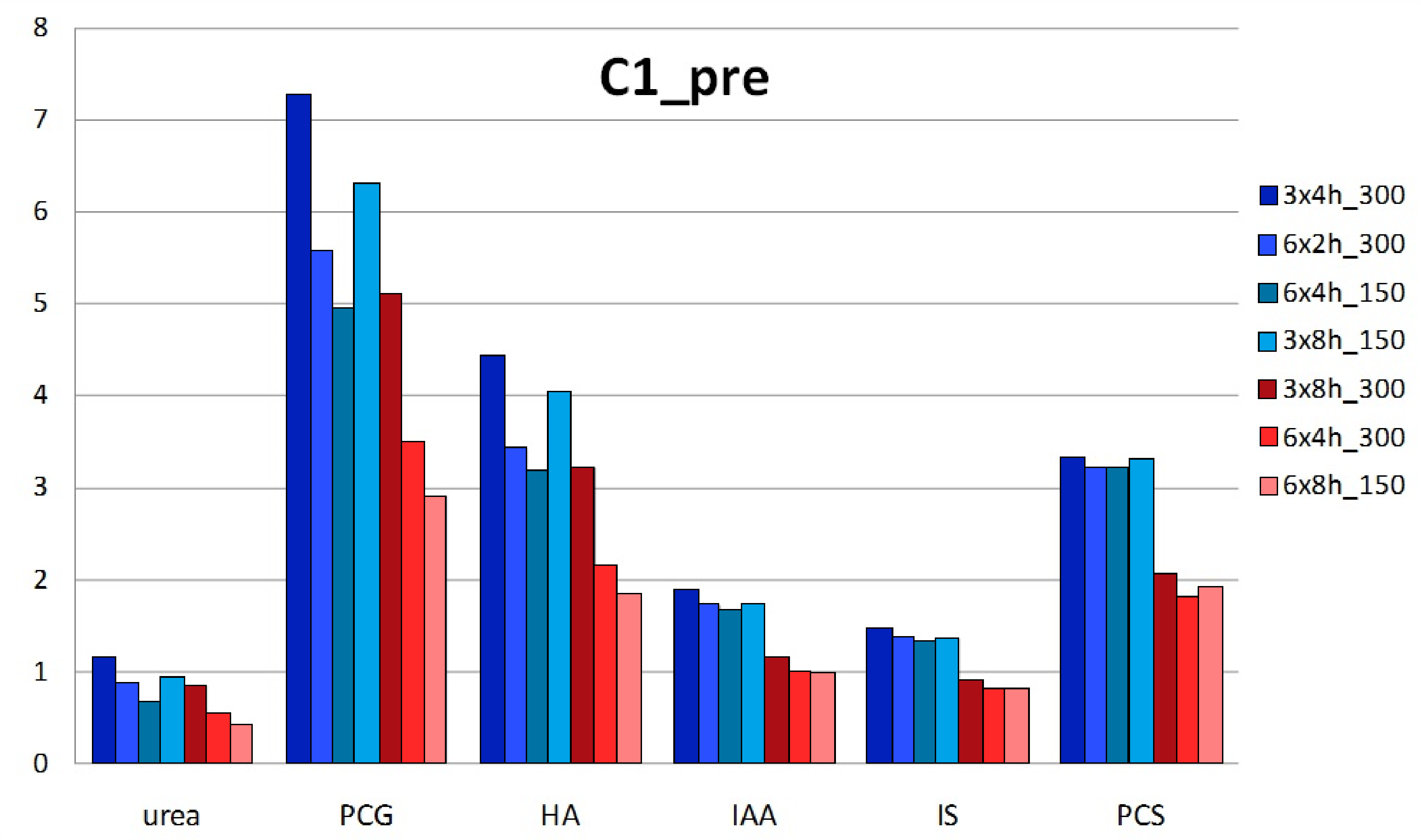
Marshall et al, AJKD , http://dx.doi.org/10.1053/j.ajkd.2012.10.020

MORTALITY



Marshall et al, AJKD , http://dx.doi.org/10.1053/j.ajkd.2012.10.020

KINETICS OF PROTEIN BOUND SOLUTES: ONLY EXTENDED OR INTENSIFIED DIALYSIS HELPS



Eloot et al, submitted

EFFECT OF FREQUENCY AND LENGTH ON GUANIDINO REMOVAL

	Reference	3*8_150	3*8_200	6*2_300	6*8_200	3*4_350
Urea	645 ± 180	682 ± 172	760 ± 200	733 ± 175*	1137 ± 307*	668 ± 173
GSA	0.175 ± 0.071	0.186 ± 0.065	0.206 ± 0.072*	0.202 ± 0.072*	0.298 ± 0.104*	0.176 ± 0.063
CREA	18 ± 5	21 ± 6*	24 ± 7*	21 ± 6*	36 ± 10*	20 ± 6*
MG	0.079 ± 0.042	0.091 ± 0.049*	0.111 ± 0.061*	0.089 ± 0.049*	0.179 ± 0.097*	0.093± 0.049*

* P<0.05, compared to reference dialysis

Eloot S et al, NDT, 24: 2225-2232; 2009

EFFECT OF FREQUENCY AND LENGTH ON GUANIDINO REMOVAL

	Reference	3*8_150	3*8_200	6*2_300	6*8_200	3*4_350
Urea	645 ± 180	682 ± 172	760 ± 200	733 ± 175*	1137 ± 307*	668 ± 173
GSA	0.175 ± 0.071	0.186 ± 0.065	0.206 ± 0.072*	0.202 ± 0.072*	0.298 ± 0.104*	0.176 ± 0.063
CREA	18 ± 5	21 ± 6*	24 ± 7*	21 ± 6*	36 ± 10*	20 ± 6*
MG	0.079 ± 0.042	0.091 ± 0.049*	0.111 ± 0.061*	0.089 ± 0.049*	0.179 ± 0.097*	0.093± 0.049*

* P<0.05, compared to reference dialysis

Eloot S et al, NDT, 24: 2225-2232; 2009

EFFECT OF FREQUENCY AND LENGTH ON GUANIDINO REMOVAL

	Reference	3*8_150	3*8_200	6*2_300	6*8_200	3*4_350
Urea	645 ± 180	682 ± 172	760 ± 200	733 ± 175*	1137 ± 307*	668 ± 173
GSA	0.175 ± 0.071	0.186 ± 0.065	0.206 ± 0.072*	0.202 ± 0.072*	0.298 ± 0.104*	0.176 ± 0.063
CREA	18 ± 5	21 ± 6*	24 ± 7*	21 ± 6*	36 ± 10*	20 ± 6*
MG	0.079 ± 0.042	0.091 ± 0.049*	0.111 ± 0.061*	0.089 ± 0.049*	0.179 ± 0.097*	0.093± 0.049*

* P<0.05, compared to reference dialysis

Eloot S et al, NDT, 24: 2225-2232; 2009

EFFECT OF FREQUENCY AND LENGTH ON GUANIDINO REMOVAL

	Reference	3*8_150	3*8_200	6*2_300	6*8_200	3*4_350
Urea	645 ± 180	682 ± 172	760 ± 200	733 ± 175*	1137 ± 307*	668 ± 173
GSA	0.175 ± 0.071	0.186 ± 0.065	0.206 ± 0.072*	0.202 ± 0.072*	0.298 ± 0.104*	0.176 ± 0.063
CREA	18 ± 5	21 ± 6*	24 ± 7*	21 ± 6*	36 ± 10*	20 ± 6*
MG	0.079 ± 0.042	0.091 ± 0.049*	0.111 ± 0.061*	0.089 ± 0.049*	0.179 ± 0.097*	0.093± 0.049*

* P<0.05, compared to reference dialysis

Eloot S et al, NDT, 24: 2225-2232; 2009

EFFECT OF FREQUENCY AND LENGTH ON GUANIDINO REMOVAL

	Reference	3*8_150	3*8_200	6*2_300	6*8_200	3*4_350
Urea	645 ± 180	682 ± 172	760 ± 200	733 ± 175*	1137 ± 307*	668 ± 173
GSA	0.175 ± 0.071	0.186 ± 0.065	0.206 ± 0.072*	0.202 ± 0.072*	0.298 ± 0.104*	0.176 ± 0.063
CREA	18 ± 5	21 ± 6*	24 ± 7*	21 ± 6*	36 ± 10*	20 ± 6*
MG	0.079 ± 0.042	0.091 ± 0.049*	0.111 ± 0.061*	0.089 ± 0.049*	0.179 ± 0.097*	0.093± 0.049*

* P<0.05, compared to reference dialysis

Eloot S et al, NDT, 24: 2225-2232; 2009

EFFECT OF FREQUENCY AND LENGTH ON GUANIDINO REMOVAL

	Reference	3*8_150	3*8_200	6*2_300	6*8_200	3*4_350
Urea	645 ± 180	682 ± 172	760 ± 200	733 ± 175*	1137 ± 307*	668 ± 173
GSA	0.175 ± 0.071	0.186 ± 0.065	0.206 ± 0.072*	0.202 ± 0.072*	0.298 ± 0.104*	0.176 ± 0.063
CREA	18 ± 5	21 ± 6*	24 ± 7*	21 ± 6*	36 ± 10*	20 ± 6*
MG	0.079 ± 0.042	0.091 ± 0.049*	0.111 ± 0.061*	0.089 ± 0.049*	0.179 ± 0.097*	0.093± 0.049*

* P<0.05, compared to reference dialysis

Eloot S et al, NDT, 24: 2225-2232; 2009