What is new in PD in 2016?
Quoi de neuf en DP en 2016 ?

Simon Davies

Keele University

self-care dialysis symposium

3ème Symposium de Dialyse Extra-Hospitalière

Scope

- The peritoneal membrane
  - Solute transport update – still a problem?
  - Mechanisms of injury
  - Inflammation, protein loss and hypoalbuminaemia
- Managing fluid status
  - What is the role of BI?
  - What are the real objectives?
- Working Together
  - Transitions: INTEGRATED
  - PDOPPS

Meta-Analysis: Peritoneal Membrane Transport, Mortality, and Technique Failure in Peritoneal Dialysis

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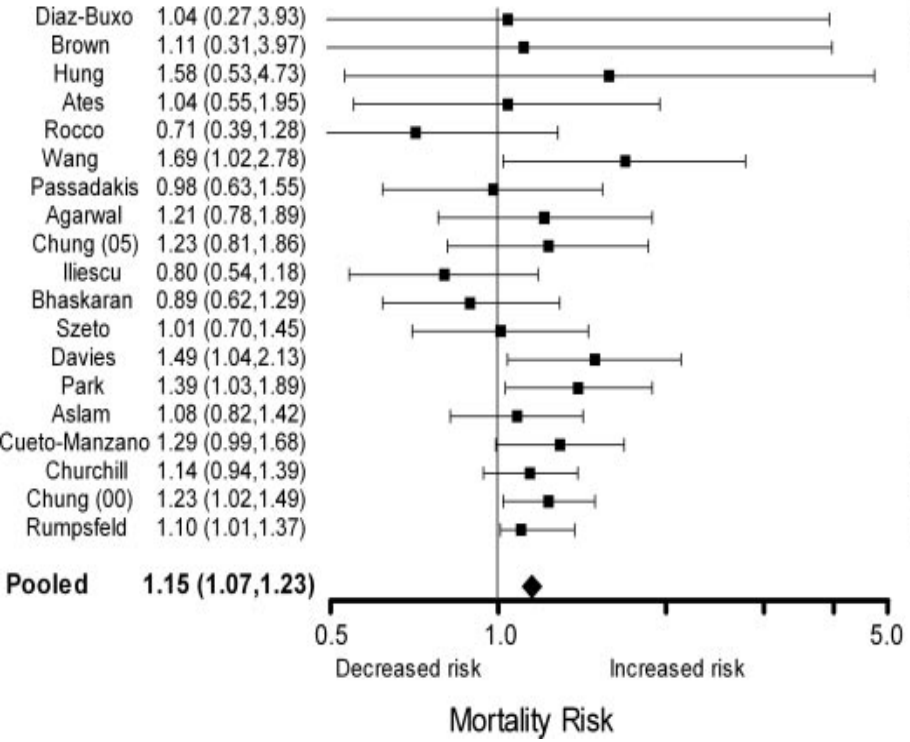
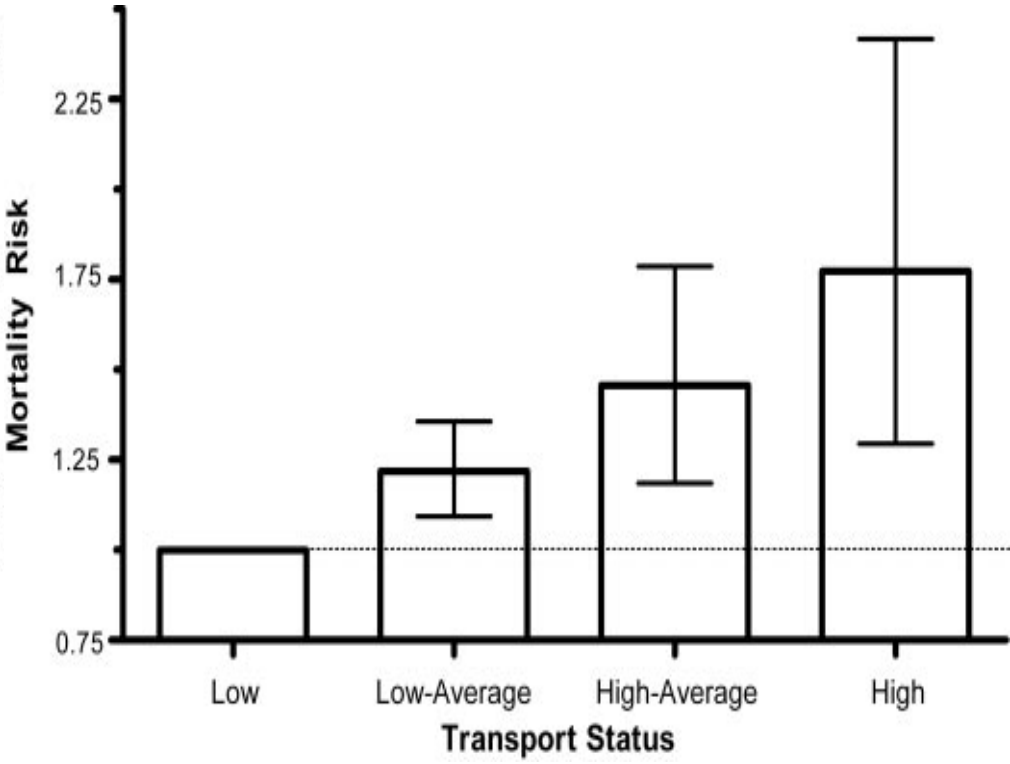
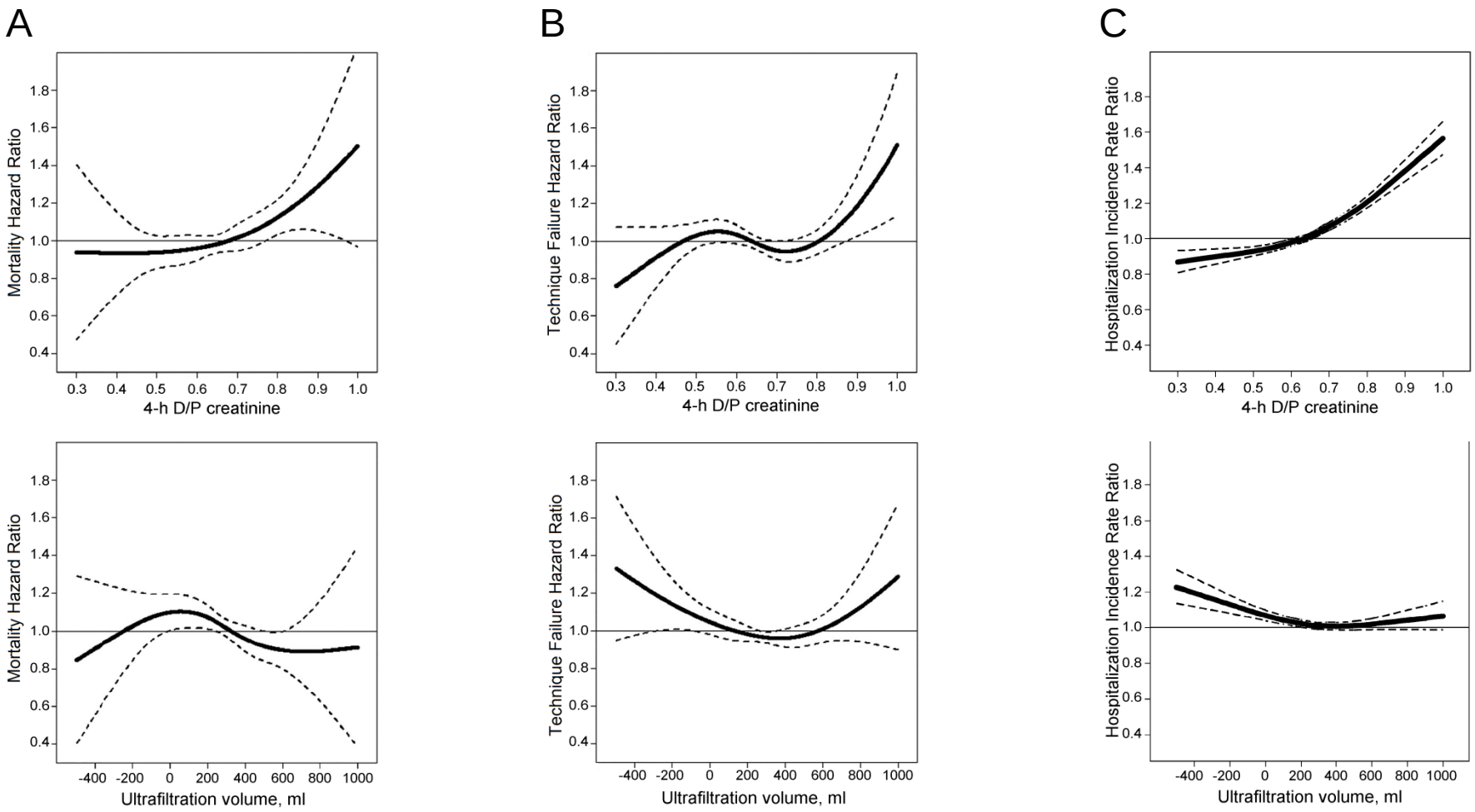
*Department of Medicine, McMaster University, and †Division of Nephrology, St. Josephs Healthcare, Hamilton, Ontario, and ‡Department of Nephrology, University of Toronto, Toronto, Ontario, Canada





J Am Soc Nephrol 17: 2591–2598, 2006.

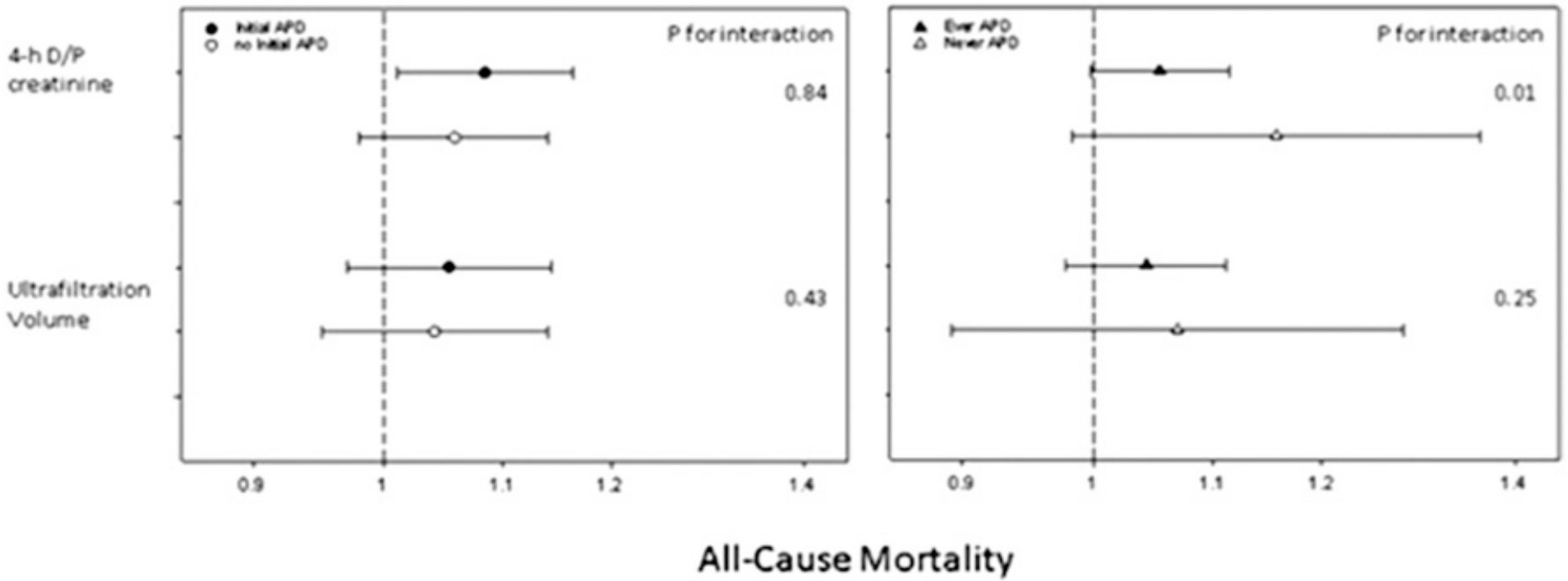


MORTALITY **TECHNIQUE FAILURE** **HOSPITALSATION**

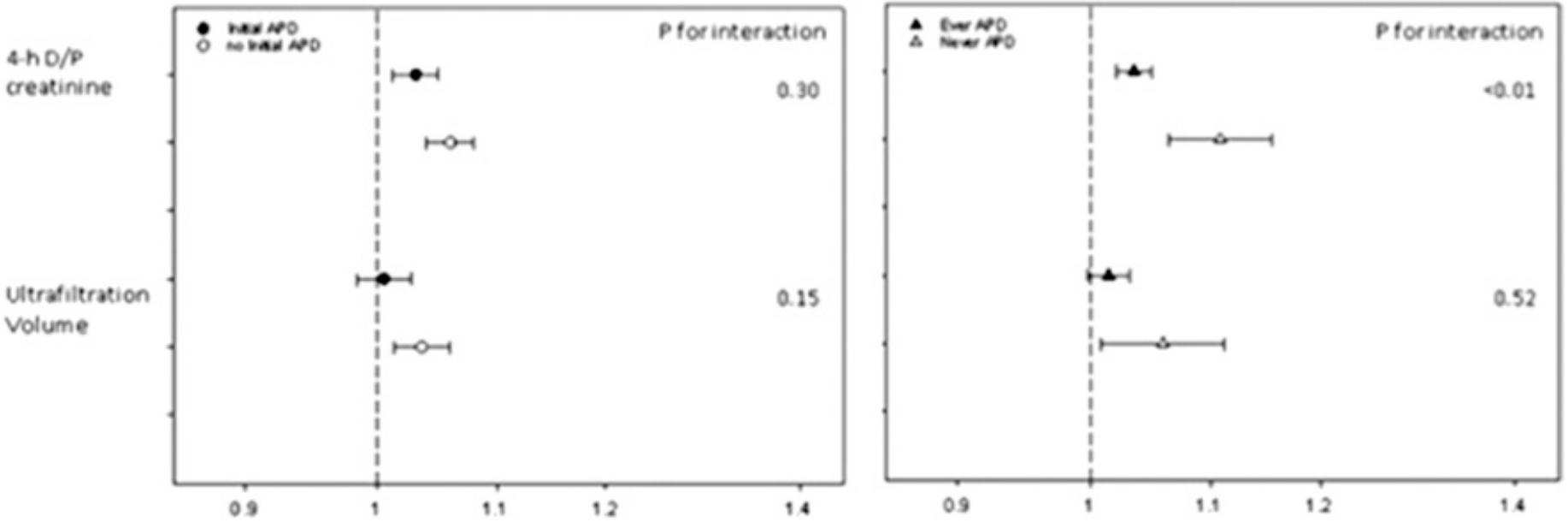
10,142 patients treated at 764 PD centres in the US – 2007 to 2011

Data adjusted for multiple confounders

Mehrotra, R et al., CJASN October, 2015



All-Cause Mortality



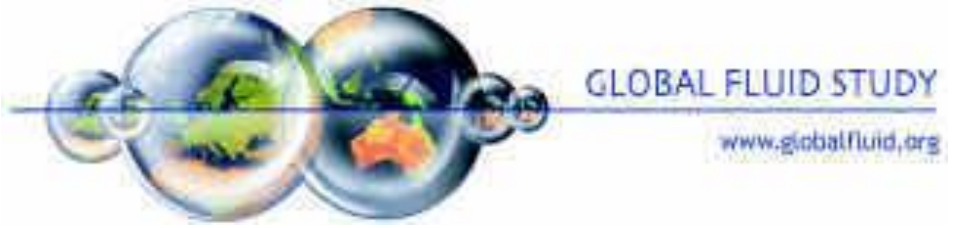
Hospitalization Incidence Rate Ratio

Table 6. Predictors of survival

Variable	Incident		Prevalent	
	Hazard Ratio (95% CI)	*P* Value	Hazard Ratio (95% CI)	*P* Value
Dialysate TNF-α	0.99 (0.34 to 2.89)	0.98	0.86 (0.22 to 3.43)	0.8
Dialysate IL-6	0.93 (0.66 to 1.31)	0.7	0.96 (0.65 to 1.44)	0.9
Dialysate IFN-γ	1.18 (0.69 to 2.00)	0.5	1.20 (0.65 to 2.19)	0.6
Plasma IL-1β	0.56 (0.15 to 2.15)	0.4	0.52 (0.16 to 1.74)	0.3
Plasma TNF-α	3.39[a] (1.26–9.16)	0.02	2.03 (0.52 to 7.93)	0.3
Plasma IL-6	2.15[b] (1.22 to 3.78)	0.008	2.68[b] (1.28 to 5.58)	0.009
Plasma IFN-γ	0.89 (0.49 to 1.60)	0.7	1.16 (0.62 to 2.16)	0.6
Age (per yr)	1.06[b] (1.05 to 1.08)	<0.001	1.06[b] (1.04 to 1.07)	<0.001
Male sex	0.94 (0.69 to 1.29)	0.7	1.28 (0.92 to 1.78)	0.1
Comorbidity (per disease)	1.68[b] (1.44 to 1.96)	<0.001	1.37[b] (1.18 to 1.58)	<0.001
Urine volume (per L)	0.95 (0.76 to 1.19)	0.7	0.65[b] (0.48 to 0.87)	0.004
Duration of PD (per mo)	1.17 (0.05 to 29.16)	0.9	1.14[b] (1.04 to 1.24)	0.005
Albumin (per 1 g/dl)	0.94[b] (0.91 to 0.97)	<0.001	0.99 (0.95 to 1.03)	0.6
PSTR (per 0.1 increase in dialysate-to-plasma creatinine ratio)	1.10 (0.98 to 1.23)	0.1	1.18[a] (1.003 to 1.41)	0.049
Body mass index	1.01 (0.97 to 1.05)	0.6	1.01 (0.98 to 1.04)	0.6

Models stratified by center. Cytokine hazard ratios are for each $1\times\log_{10}$ change in concentration. CI, confidence interval.
[a] P=0.01–0.05.
[b] P<0.01.

Cox model, stratified by centre.



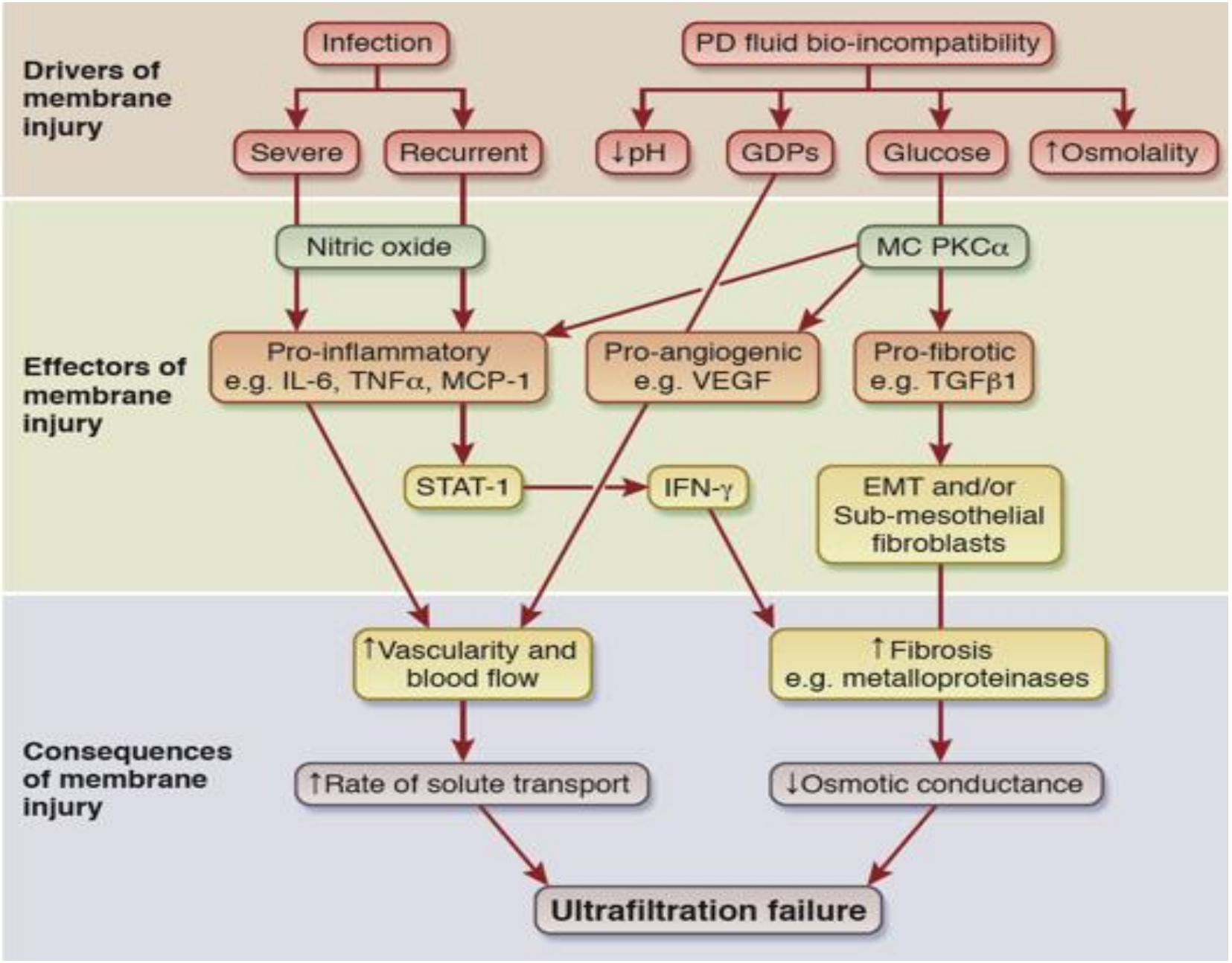
Why might high transport be associated with worse outcomes?

- Worse ultrafiltration
  - Early loss of osmotic gradient causing less efficient aquaporin mediated UF
  - More rapid fluid reabsorption in long dwell via the small pores
- Association with membrane inflammation
- Increased protein losses

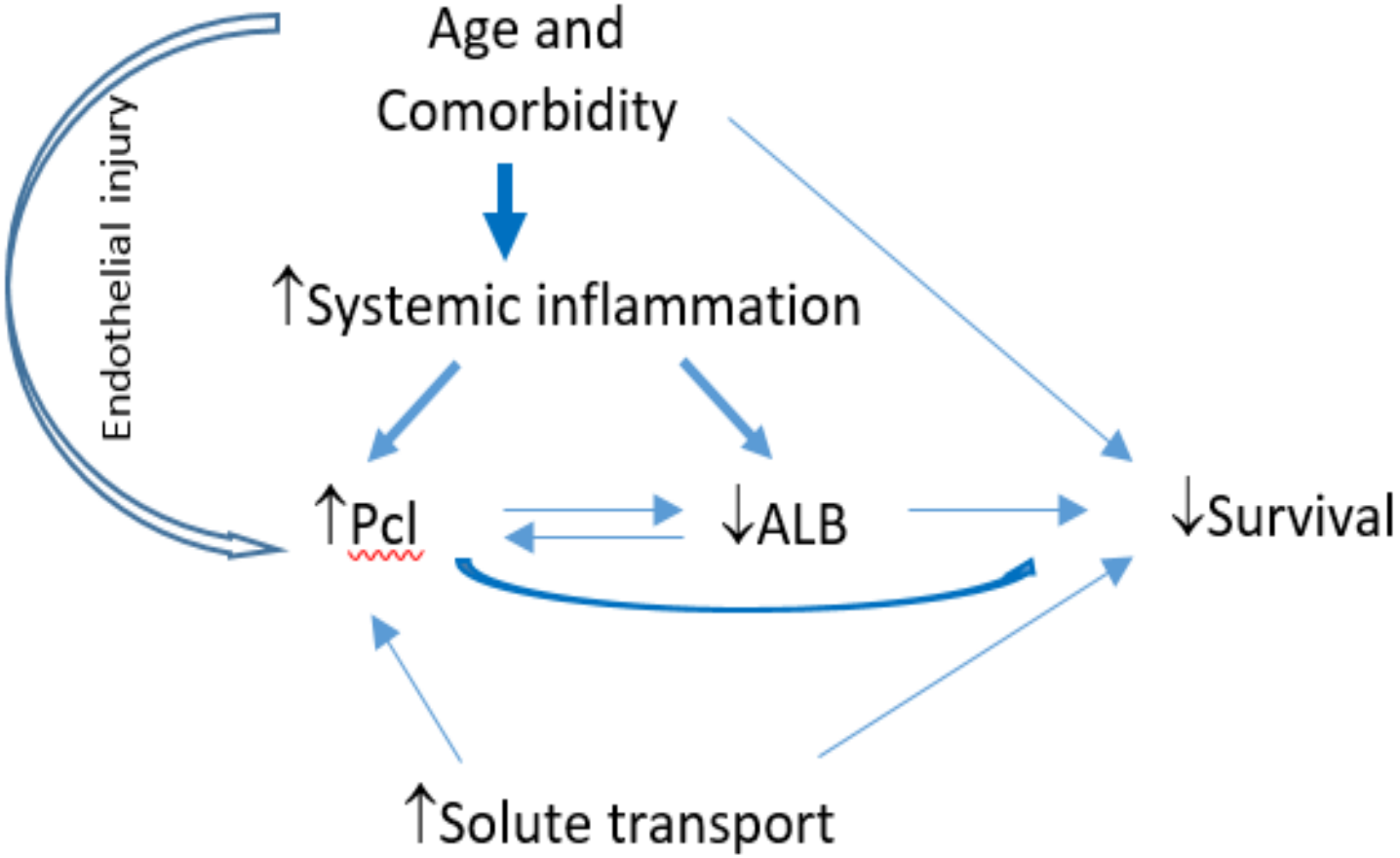
GLOBAL Fluid Study: Associations of Inflammatory Cytokine Levels with EPS Status, Age and Time to end of PD

Dependent Variable		EPS		Age		Time until PD End	
		Coefficient (95% CI)	p value	Coefficient (95% CI)	p value	Coefficient (95% CI)	p value
Dialysate	IL-6	0.79 (0.03, 1.56)*	0.043	0.009 (-0.014, 0.033)	0.43	0.27 (0.13, 0.42)*	<0.001
	IL-1β	1.06 (-0.11, 2.23)	0.075	0.022 (-0.012, 0.056)	0.20	0.19 (-0.08, 0.47)	0.17
	IFN-γ	0.62 (-0.06, 1.29)	0.073	0.016 (-0.005, 0.036)	0.14	0.085 (-0.045, 0.215)	0.20
	TNF-α	0.64 (0.23, 1.05)*	0.002	0.019 (0.007, 0.031)*	0.001	0.048 (-0.026, 0.123)	0.20
Plasma	IL-6	0.42 (0.07, 0.78)*	0.020	0.016 (0.005, 0.026)*	0.003	0.13 (0.05, 0.21)*	0.001
	IL-1β	0.66 (-0.65, 1.97)	0.33	-0.023 (-0.064, 0.017)	0.26	-0.21 (-0.55, 0.13)	0.23
	IFN-γ	-0.30 (-0.69, 0.09)	0.14	0.014 (0.001, 0.027)*	0.036	0.12 (0.02, 0.22)*	0.017
	TNF-α	0.13 (-0.13, 0.39)	0.31	0.010 (0.002, 0.017)*	0.011	0.45 (-0.007, 0.098)	0.090
Solute Transport	D/P Cr	0.024 (-0.054, 0.102)	0.55	-0.0017 (-0.0039, 0.0006)	0.14	0.035 (0.023, 0.047) *	<0.001

Lambie, M. et al., NDT, 2016



Davies, S. KI, 2016, in press


Age and
Comorbidity
Endothelial injury
↑Systemic inflammation
↑Pcl
↓ALB
↓Survival
↑Solute transport

ASSOCIATIONS WITH PERITONEAL PROTEIN CLEARANCE

	β	95% CI
D/P creatinine (for each 0.1 increase)	**11.88**	**7.8-15.9**
lg Dialysate IL6 AR (for each unit increase)	**8.704**	**0.82-16.59**
lg Plasma IL6 (for each unit increase)	5.55	-10.05-21.15
Plasma Albumin (for each 1g/L increase)	**-2.695**	**-3.76- -1.63**
Age (year)	0.036	-0.28-0.35
gender (compare with female)	-0.451	-9.46-8.56
Comorbidity Grade 1 (compared with Grade 0)	6.723	-3.05-16.49
Comorbidity Grade 2 (compared with Grade 0)	10.01	-9.81-29.83

3 centres, 2 UK, 1 Korea; n=257 incident patients.

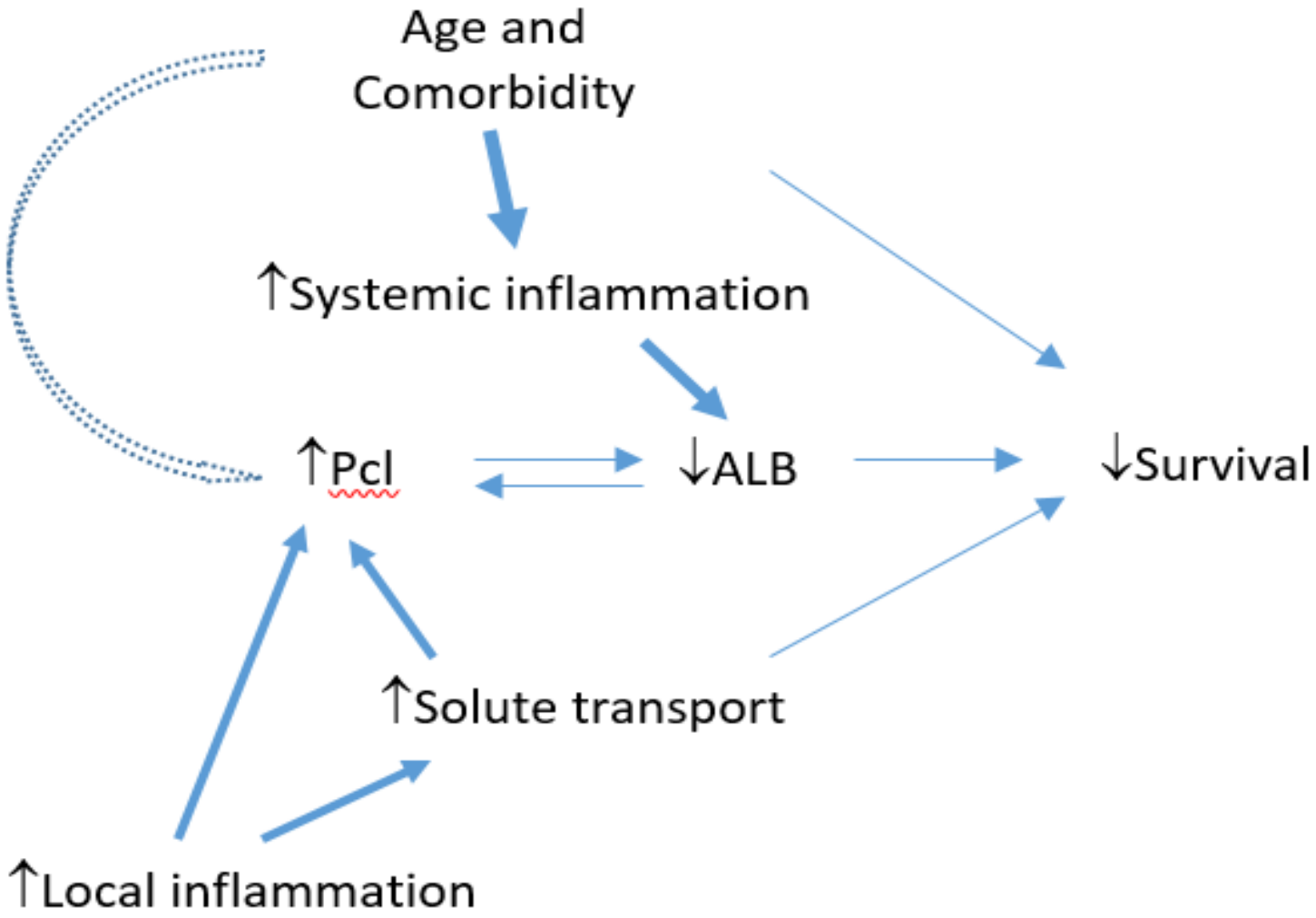
GLOBAL FLUID STUDY

www.globalfluid.org

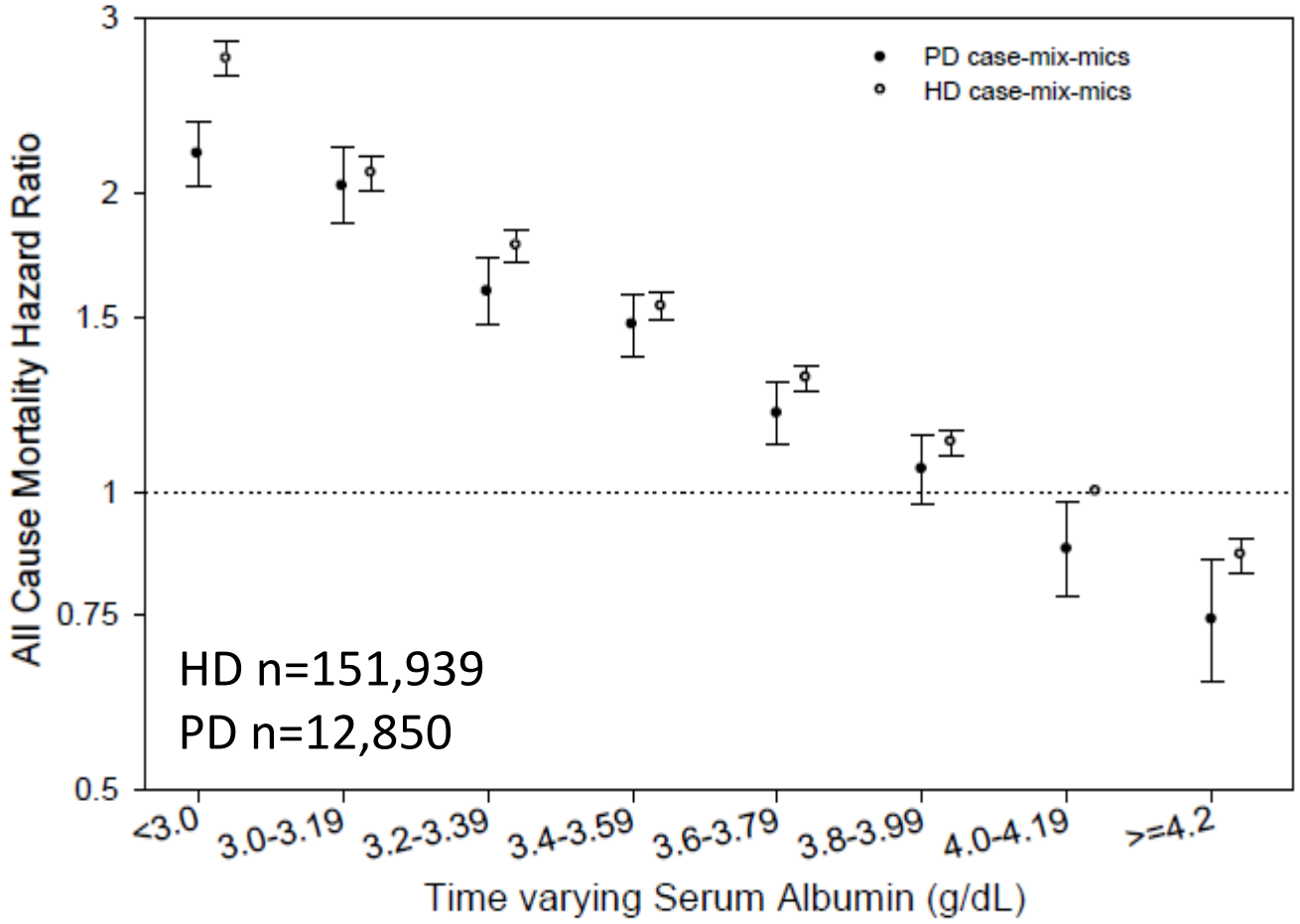
SURVIVAL	HR	95%CI
Age (per year)	**1.07**	**1.05-1.09**
D/P creatinine	1.4	0.25-7.69
Female gender	0.98	0.65-1.46
Plasma IL-6 (per log order)	**2.36**	**1.19 - 4.7**
Peritoneal IL-6 AR (per log order)	1.02	0.71-1.48
Comorbidity grade 1	**1.83**	**1.1 - 3.04**
Comorbidity grade 2	**3.76**	**1.62-8.73**
Protein Clearance (per ml/min)	1.002	1-1.008
Plasma Albumin (per g/l)	**0.92**	**0.88 - 0.97**

GLOBAL FLUID STUDY

www.globalfluid.org

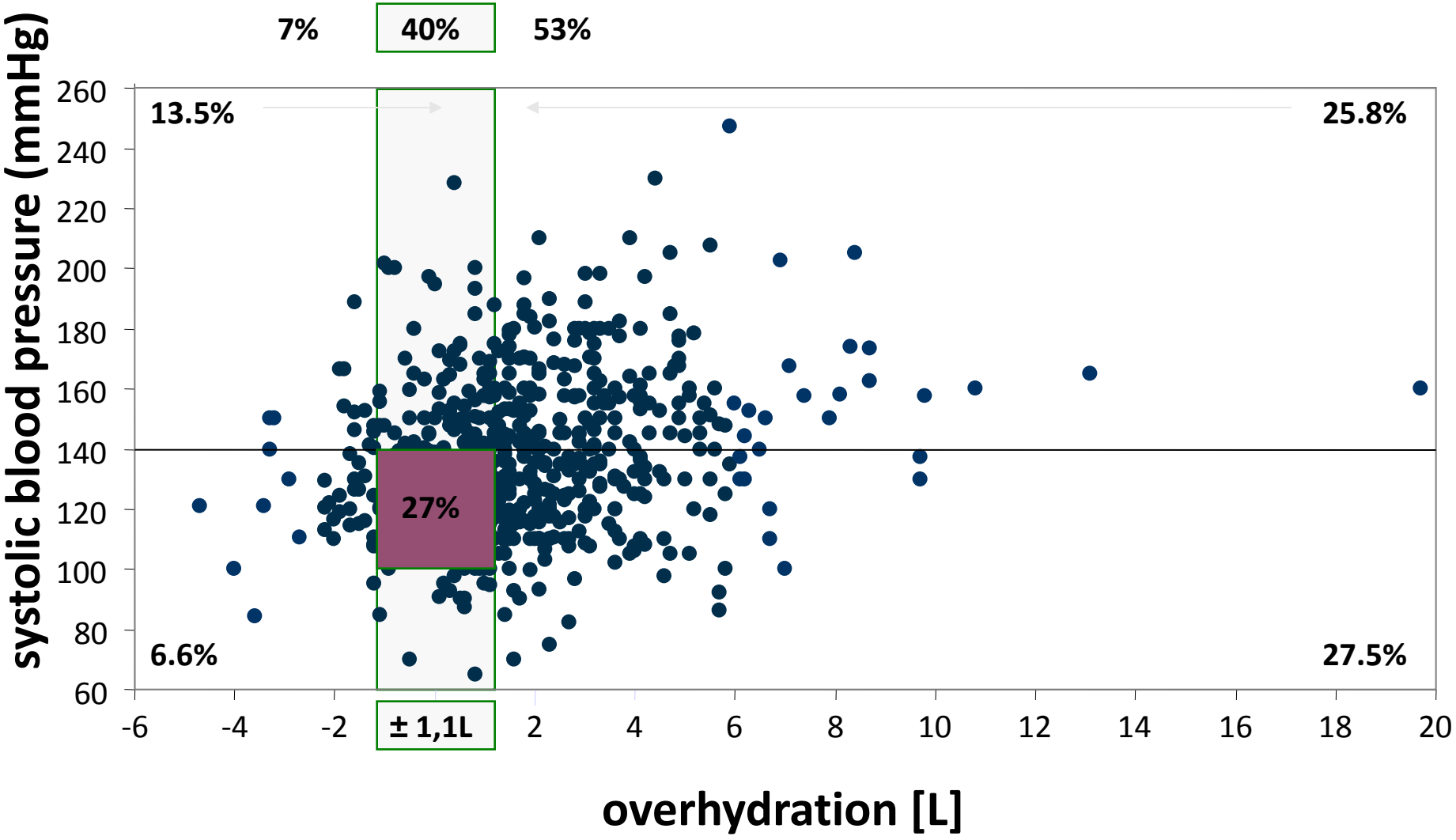

Age and
Comorbidity
↑Systemic inflammation
↑Pcl
↓ALB
↓Survival
↑Solute transport
↑Local inflammation

Case-mix adjusted relative survival according to plasma albumin by dialysis modality



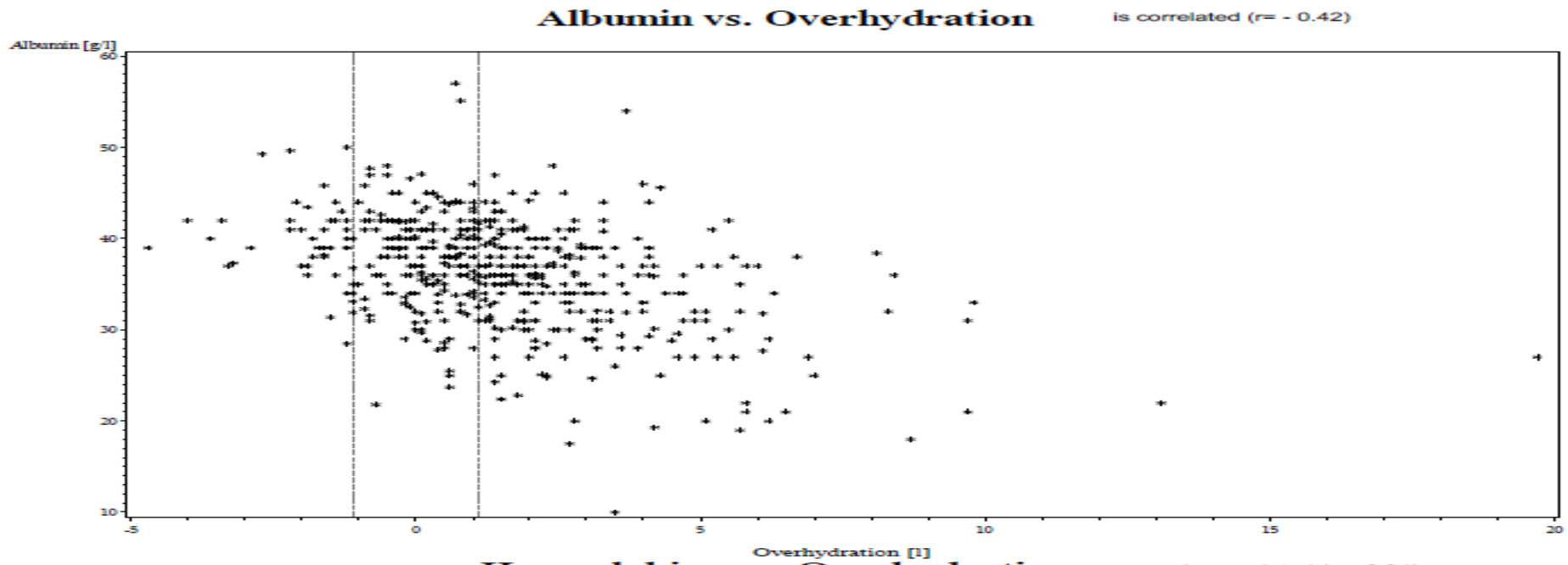
Mehrotra, R; AJKD, 2011,

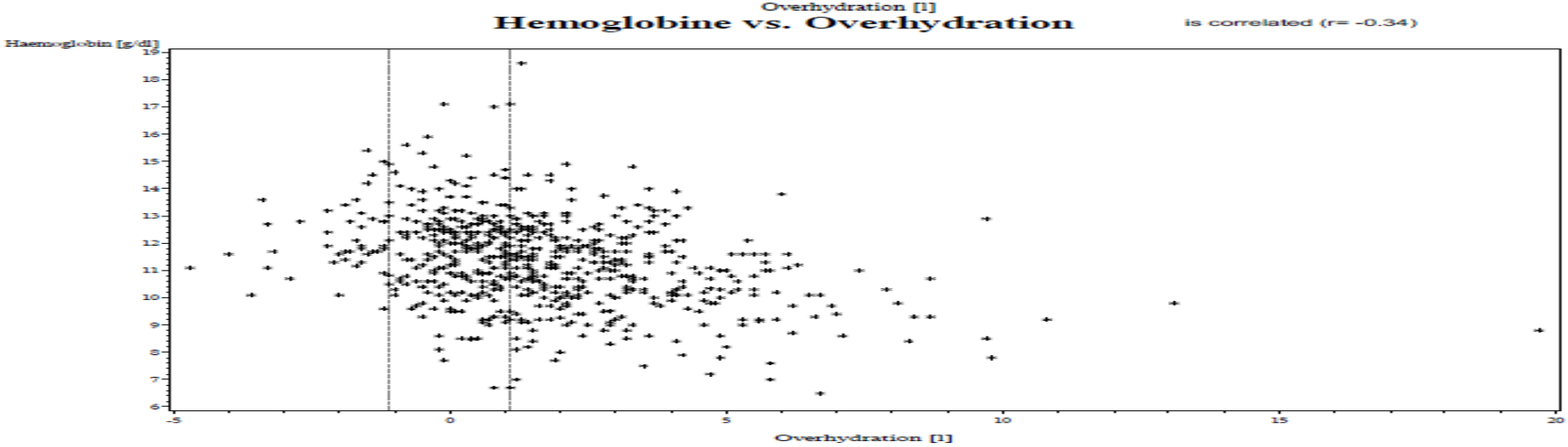
Overhydration & Blood pressure



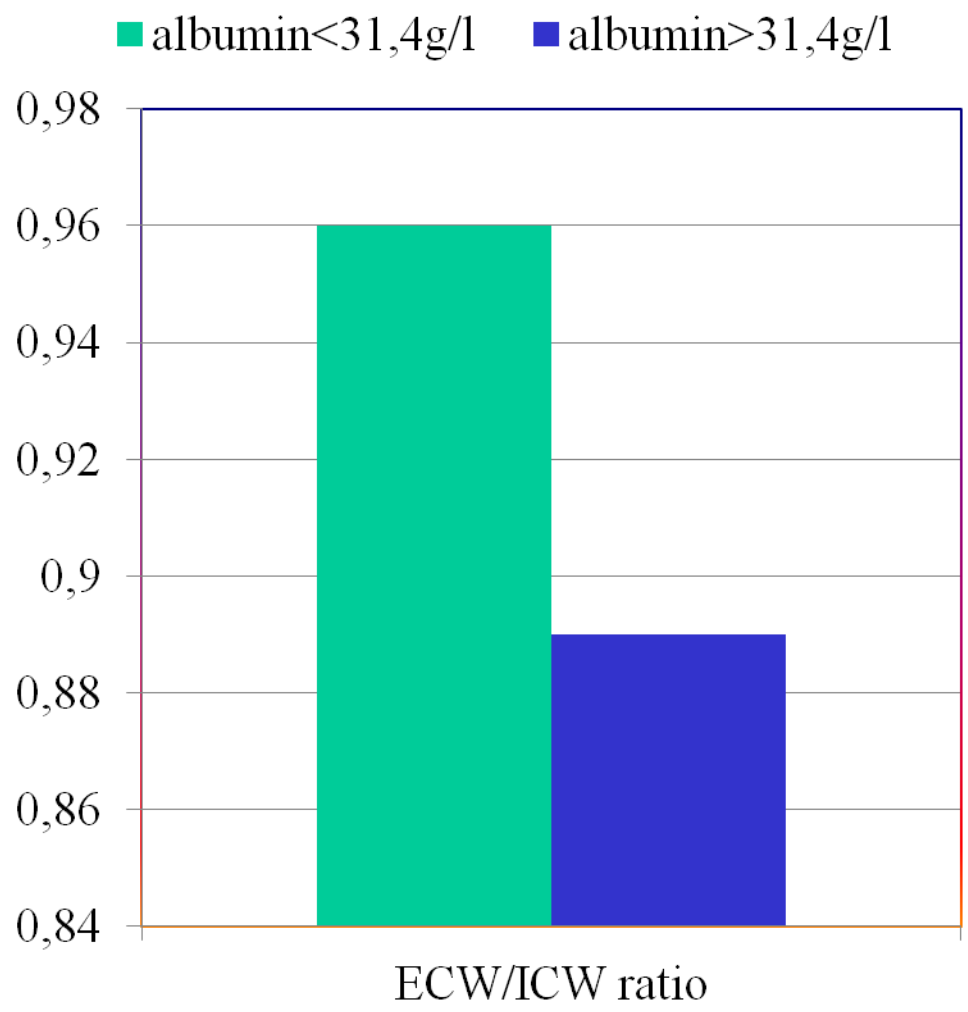
Van Biesen et al. (2011) Fluid Status in Peritoneal Dialysis Patients: The European Body Composition Monitoring (EuroBCM) Study Cohort. PLoS ONE 6(2): e17148.

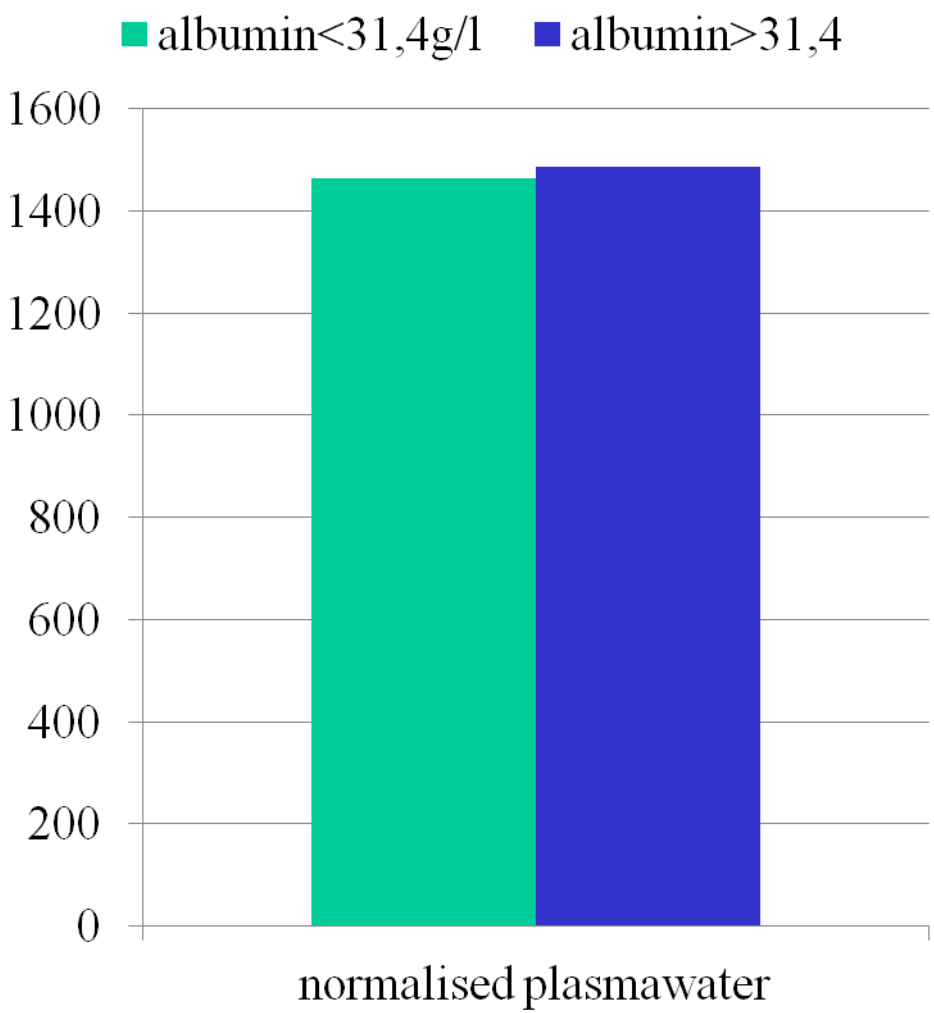
EuroBCM:
the relation between albumin and overhydration





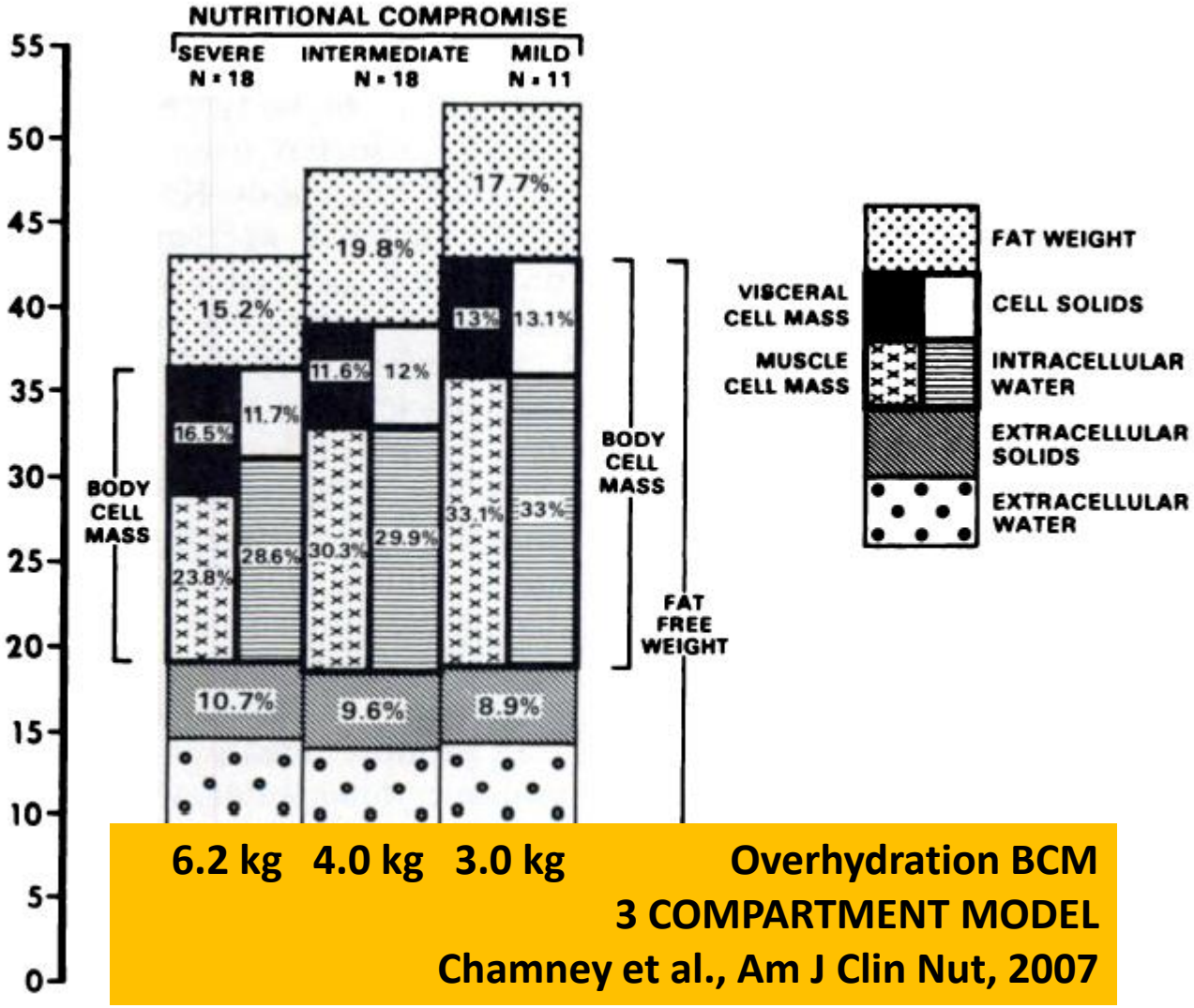
Overhydration in PD patients





Biju J., cJASN, 2010

Body composition in chronic undernutrition



6.2 kg 4.0 kg 3.0 kg Overhydration BCM

3 COMPARTMENT MODEL

Chamney et al., Am J Clin Nut, 2007

Barac-Nieto M, Am J Clin Nut, 1978

Can BI inform clinical management?

Is it any better that the standard approach of clinically setting a target weight?

http://www.kidney-international.org

Longitudinal bioimpedance vector plots add little value to fluid management of peritoneal dialysis patients

Does BI monitoring add value?
ClinicalTrials.gov NO: NCT00801112
Vector plots to show direction of change – NOT target driven
4 nested studies in an overarching RCT using a PROBE design
308 patients
Follow-up 1 year – primary endpoint calculated fluid status from BI

Tan, BK, Yu Z, et al. KI 2015

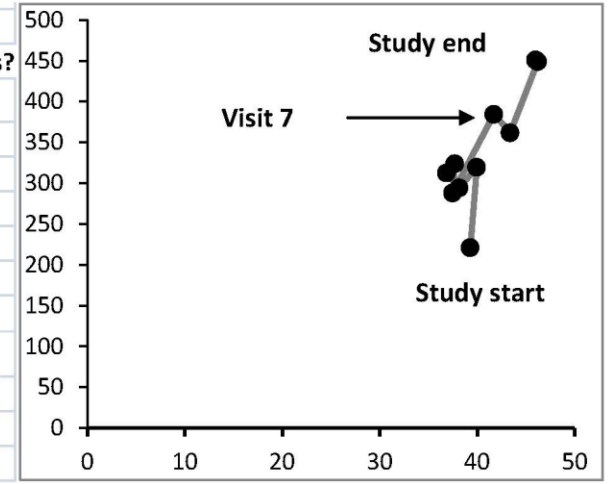
1: Data Entry

Visit number 7	7	Do you need to intervene to achieve target weight?	2-Yes
Date 7	28/12/2011	If the patient is overhydrated,	
Systolic BP (mmHg) 7	135	what are the new intervention(s) used to optimize fluid status?	
Diastolic BP (mmHg) 7	77		
Target weight (kg) 7	51	Reduce fluid intake	2-Yes
Clinical weight (kg) 7	51	Start diuretics/increase dose	
		Use 'stronger PD solution	2-Yes
Clin. examination:		Start Icodextrin	
Raised JVP? 7	3-Not done	Others (enter text)	
Chest crackles? 7	3-Not done		
Oedema? 7	1-No	If the patient is underhydrated,	
		what are the new intervention(s) used to optimize fluid status?	
Bioimpedance data:			
Resistance,R (ohm) 7	517.7	Increase fluid intake	
Reactance,Xc (ohm) 7	56.2	Stop diuretics/decrease dose	
		Use 'weaker' PD solution	
		Stop Icodextrin	
		Others (enter text)	
New Target weight (kg) 7	50		
Clinical decision 7	TARGET WEIGHT DECREASED		
BP 7	1-Optimum		
Fluid status by clin.exam 7	1-Optimum		
Fluid status by BIA 7	2-Overhydrated		

4. Record interventions

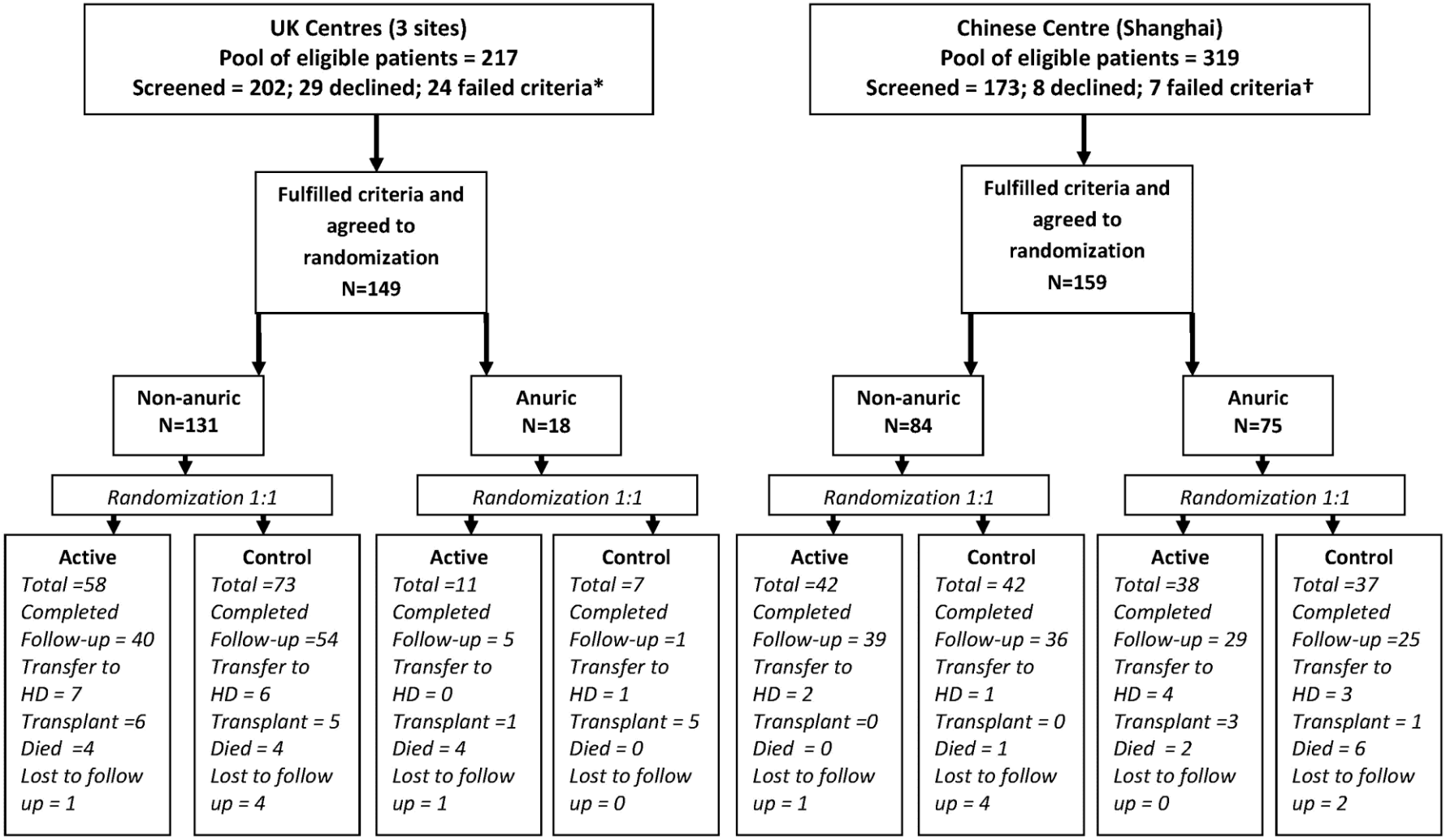
2: Serial Plot BI Data (not done in controls)

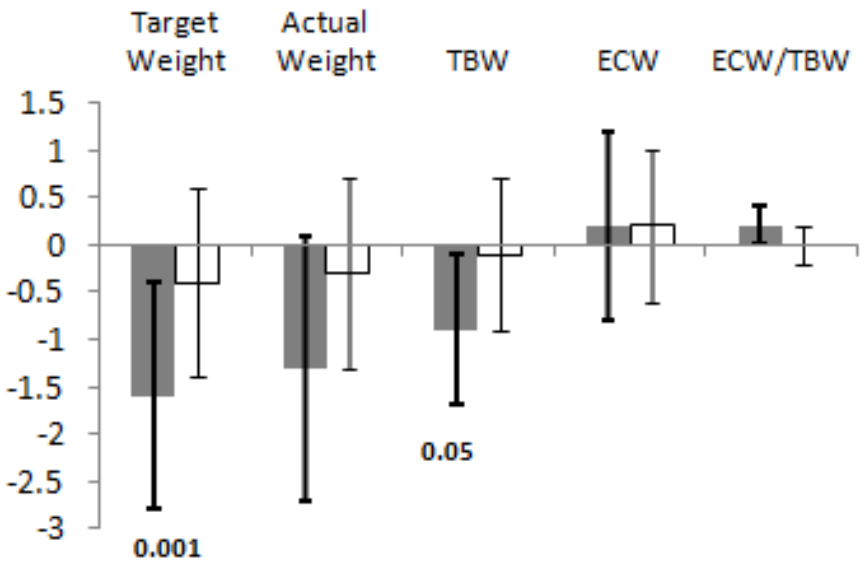
(Height)^2 /Reactance (m^2/Ohm) – increasing tissue oedema



(Height)^2 /Resistance (m^2/Ohm) – increasing total body water

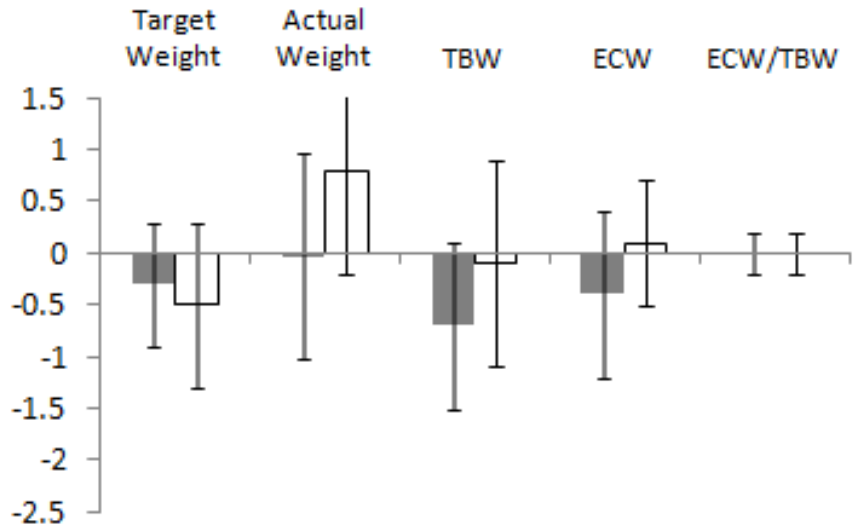
3: Combine BI Data with Clinical to inform decision


UK Centres (3 sites)
Pool of eligible patients = 217
Screened = 202; 29 declined; 24 failed criteria*
Fulfilled criteria and agreed to randomization N=149
Non-anuric N=131
Anuric N=18
Randomization 1:1
Randomization 1:1
Active
Total =58
Completed Follow-up = 40
Transfer to HD = 7
Transplant =6
Died =4
Lost to follow up = 1
Control
Total =73
Completed Follow-up =54
Transfer to HD = 6
Transplant = 5
Died = 4
Lost to follow up = 4
Active
Total =11
Completed Follow-up = 5
Transfer to HD = 0
Transplant =1
Died = 4
Lost to follow up = 1
Control
Total =7
Completed Follow-up =1
Transfer to HD = 1
Transplant = 5
Died = 0
Lost to follow up = 0
Chinese Centre (Shanghai)
Pool of eligible patients = 319
Screened = 173; 8 declined; 7 failed criteria†
Fulfilled criteria and agreed to randomization N=159
Non-anuric N=84
Anuric N=75
Randomization 1:1
Randomization 1:1
Active
Total =42
Completed Follow-up = 39
Transfer to HD = 2
Transplant =0
Died = 0
Lost to follow up = 1
Control
Total = 42
Completed Follow-up = 36
Transfer to HD = 1
Transplant = 0
Died = 1
Lost to follow up = 4
Active
Total =38
Completed Follow-up = 29
Transfer to HD = 4
Transplant =3
Died = 2
Lost to follow up = 0
Control
Total =37
Completed Follow-up =25
Transfer to HD = 3
Transplant = 1
Died = 6
Lost to follow up = 2



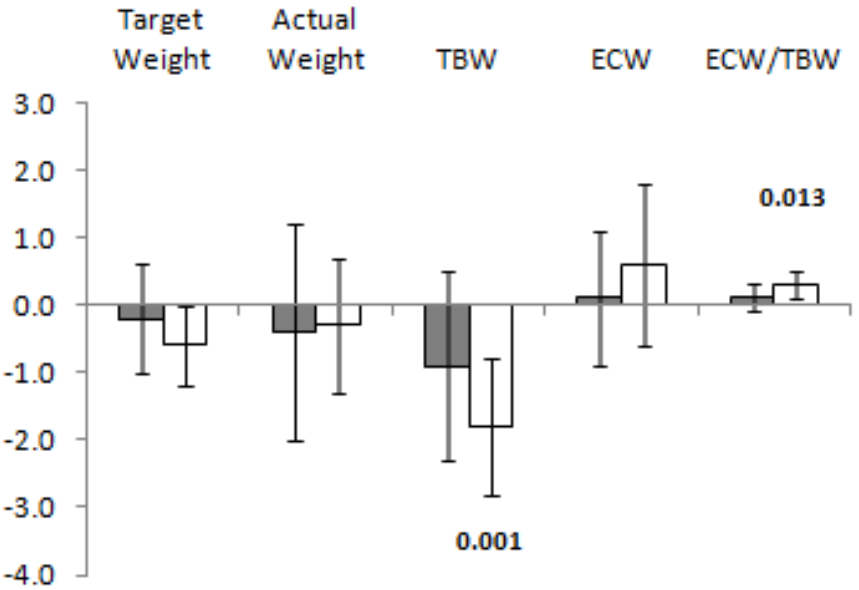
UK – NON-ANURIC PATIENTS n=131

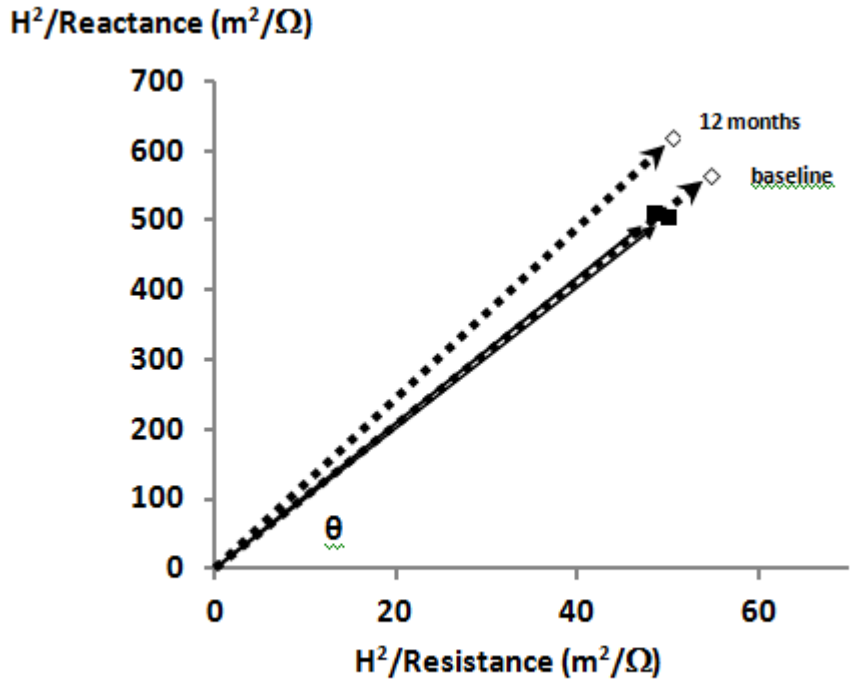
CONTROLS – stable
INTERVENTION – target weight reduced, no change in ECW or ECW/RATIO, relative preservation of urine volume



SHANGHAI – NON-ANURIC PATIENTS n=84

BOTH GROUPS – NO CHANGE





SHANGHAI – ANURIC PATIENTS n=75

CONTROLS – Fluid status worsened with an increase in the phase angle, drop in TBW without a concomitant change in ECW/TBW ratio

INTERVENTION - Fluid status stable, with a stable BI vector. This was associated with an increase in the glucose prescription

	Control (All)	BI Group (All)	Controls (Non-Anuric)	BI group (Non-Anuric)	Controls (Anuric)	BI group (Anuric)
Number of patients	*157*	*150*	*113*	*101*	*44*	*49*
Number of visits	*643*	*631*	*474*	*429*	*169*	*202*
TBW (L)						
Baseline constant	34.7 (31.6, 37.8)	34.1 (31.1- 37.0)	33.7 (31.0, 36.5)	33.6 (30.4, 36.7)	31.8 (29.3, 34.3)	33.1 (29.6, 36.7)
Gender (male)	10.1* (8.4, 11.9)	8.8 * (7.2 -10.4)	11.7* (9.6, 13.9)	9.2* (7.1, 11.3)	8.6 * (5.8, 11.4)	8.8* (6.4, 11.3)
Age (year)	0.06 (0.0, 0.12)	-0.01 (-0.07- 0.05)	0.00 (-0.07, 0.07)	-0.01 (-0.09, 0.06)	0.21* (0.09, 0.32)	-0.03 (-0.12, 0.06)
Comorbidity Grade 1	-0.84 (-2.81, 1.13)	0.73 (-1.13, 2.60)	0.38 (-1.91, 2.67)	1.86 (-0.42, 4.14)	-2.46 (-5.55, 0.63)	-1.70 (-4.59, 1.18)
Comorbidity Grade 2	-1.96 (-6.27, 2.4)	0.95 (-3.63, 5.53)	-1.53 (-5.86, 2.80)	1.43 (-3.33, 6.20)	-	-
Visit 2 v. baseline	0.40 (-0.07, 0.86)	-0.12 (-0.55, 0.30)	0.44 (-0.08, 0.96)	-0.44 (-0.91, 0.03)	0.23 (-0.72, 1.19)	0.57 (-0.30, 1.43)
Visit 3 v. baseline	0.11 (-0.36 - 0.59)	-0.41 (-0.83, 0.0)	0.12 (-0.41, 0.65)	-0.57†(-1.03, -0.10)	0.06 (-0.91, 1.03)	-0.08 (-0.92, 0.76)
Visit 4 v. baseline	-0.45 (-0.95- 0.05)	-0.51† (-0.9, -0.06)	-0.13 (-0.68, 0.42)	-0.52†(-1.01, -0.02)	-1.49* (-2.58, -0.41)	-0.46 (-1.35, 0.42)
Visit 5 v. baseline	-0.45 (-0.96 - 0.06)	-0.79† (-1.24, -0.4)	-0.15 (-0.71, 0.41)	-0.81*(-1.30, -0.31)	-1.52* (-2.67, -0.37)	-0.79 (-1.70, 0.12)
ECW/TBW ratio (expressed as percentage)						
Baseline constant	46.3 (43.8, 48.7)	46.4 (43.9, 48.8)	46.9 (45.1, 48.7)	46.3 (43.8, 48.9)	47.6 (42.1, 53.1)	46.8 (43.0, 50.5)
Gender (male)	-2.78 * (-4.37,-1.18)	-3.32* (-4.97,-1.67)	-3.53* (-5.36, -1.69)	-2.58* (-4.54, 0.62)	-3.68† (-7.00,-0.36)	-4.26* (-7.37, -1.14)
Age (year)	0.07† (0.01, 0.12)	0.14* (0.08, 0.20)	0.06† (0.00, 0.12)	0.12* (0.05, 0.19)	0.05 (-0.08, 0.18)	0.17* (0.05, 0.28)
Comorbidity Grade 1	1.54 (-0.28, 3.36)	2.30† (0.43, 4.16)	1.15 (-0.79, 3.08)	1.31 (-0.81, 3.42)	1.21 (-2.62, 5.05)	3.97† (0.33, 7.62)
Comorbidity Grade 2	8.81* (4.83, 12.78)	1.61 (-2.96, 6.18)	8.72* (4.97, 12.46)	1.71 (-2.69, 6.11)	-	-
Visit 2 v. baseline	0.08 (-0.89, 1.04)	0.57 (-0.43, 1.57)	-0.29 (-1.37, 0.79)	0.32 (-0.93, 1.57)	1.05 (-0.97, 3.06)	1.11 (-0.51, 2.72)
Visit 3 v. baseline	0.52 (-0.46, 1.51)	-0.09 (-1.07, 0.89)	0.44 (-0.67, 1.55)	-0.26 (-1.49, 0.97)	0.74 (-1.29, 2.78)	0.35 (-1.22, 1.91)
Visit 4 v. baseline	-0.49 (-1.53, 0.55)	0.45 (-0.58, 1.48)	-0.39 (-1.54, 0.76)	0.37 (-0.94, 1.67)	-0.83 (-3.10, 1.45)	0.71 (-0.94, 2.36)
Visit 5 v. baseline	0.96 (-0.10, 2.03)	0.85 (-0.19, 1.90)	0.31 (-0.85, 1.47)	0.50 (-0.81, 1.81)	3.25* (0.85, 5.66)	1.79† (0.09, 3.48)

What did we learn?

- Non-anuric PD patients have stable fluid status
- Telling patients to reduce their weight, even with dietetic support in the routine clinic does not necessarily translate in improved fluid status/BP
- Spontaneous reduction in TBW (likely due to loss of lean mass) is responsible for worsening fluid status in anuric patients
- The only intervention that made a difference to ECW was increased glucose prescription – and availability of BI measurements appeared to influence this – leading to stable fluid status in anuric patients in Shanghai

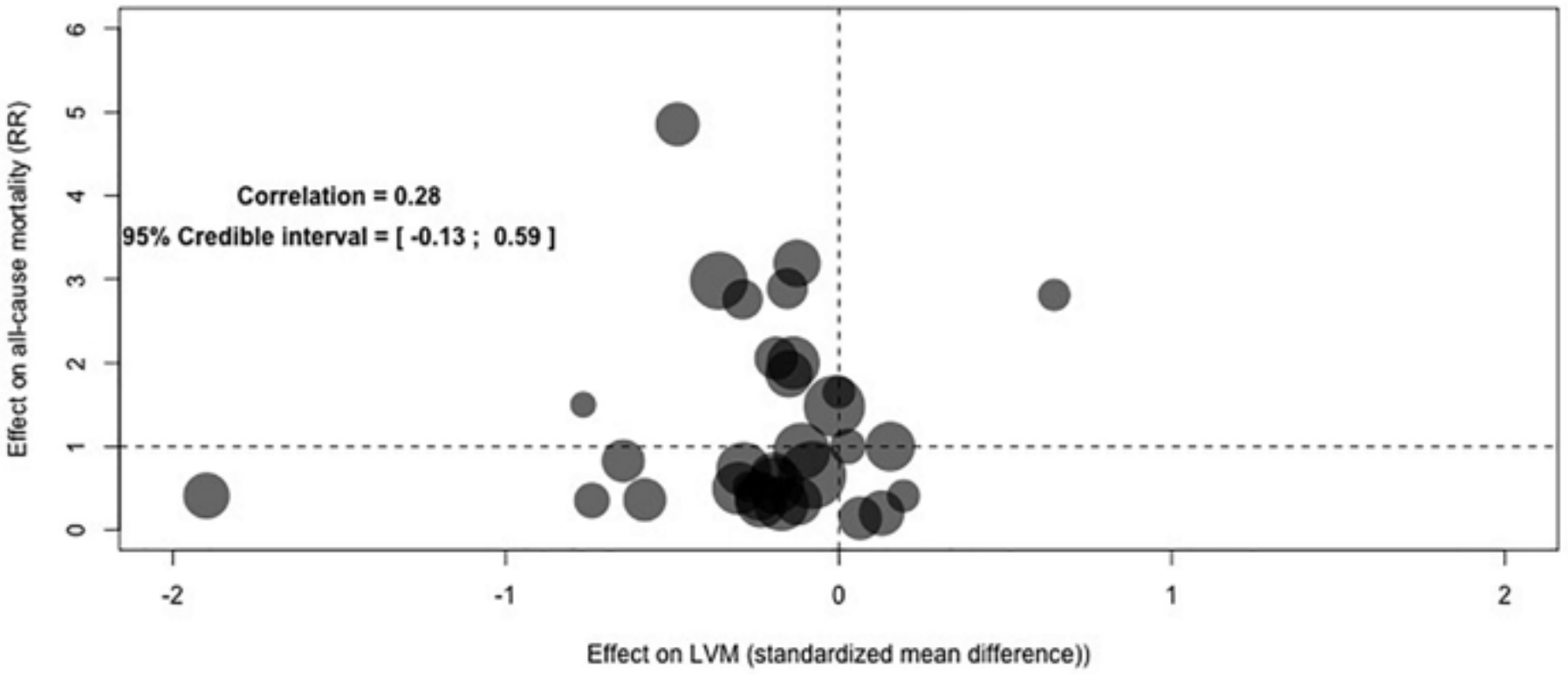
What else did we learn?

- However, this benefit may also be due to less loss in muscle mass
- BI may facilitate weight reduction without loss in RRF – and better preservation of RRF may reduce rate of cardiac dysfunction
- Designing trials around a complex assessment and intervention is difficult
  - Practice patterns differ
  - Multiple interventions over time
  - Both capture and analysis of data is challenging
- BI vector analysis does not lend itself to setting target weights – clinicians want a simple output to follow

BI and fluid management: Where do we go from here?

- Volume management is difficult and with room for improvement – guidelines not that clear
- We have a potentially useful clinical tool.
- More trials, more longitudinal data needed.
- History tells us that normalising everything in Dialysis patients does not always lead to the best outcomes – is achieving normovolaemia just a test of cardiovascular resilience or is it really good for patients?
- What about residual kidney function? Which is the best surrogate to aim for? – BP, LVH, RRF, PWV, survival, dialysis symptoms, shared decision making, better patient engagement....

Does ↓ in LVM translate into survival benefit?
Meta-analysis 32 trials, 5044 participants



Badve S, Am J Kid Dis, in press

Scope

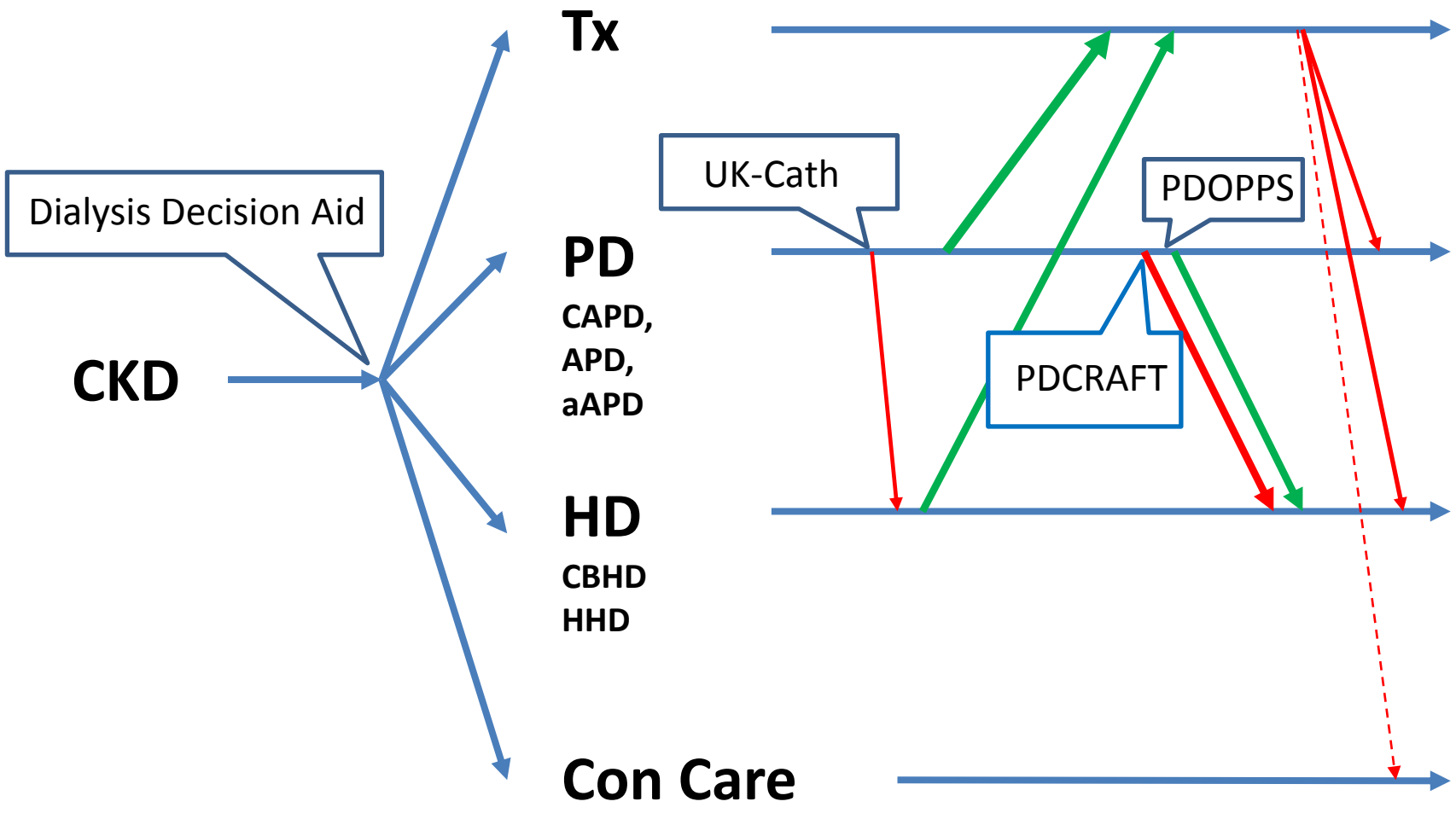
- The peritoneal membrane
  - Solute transport update – still a problem?
  - Mechanisms of injury
  - Inflammation, protein loss and hypoalbuminaemia
- Managing fluid status
  - What is the role of BI?
  - What are the real objectives?
- Working Together
  - Transitions: INTEGRATED
  - PDOPPS

INTEGRATED

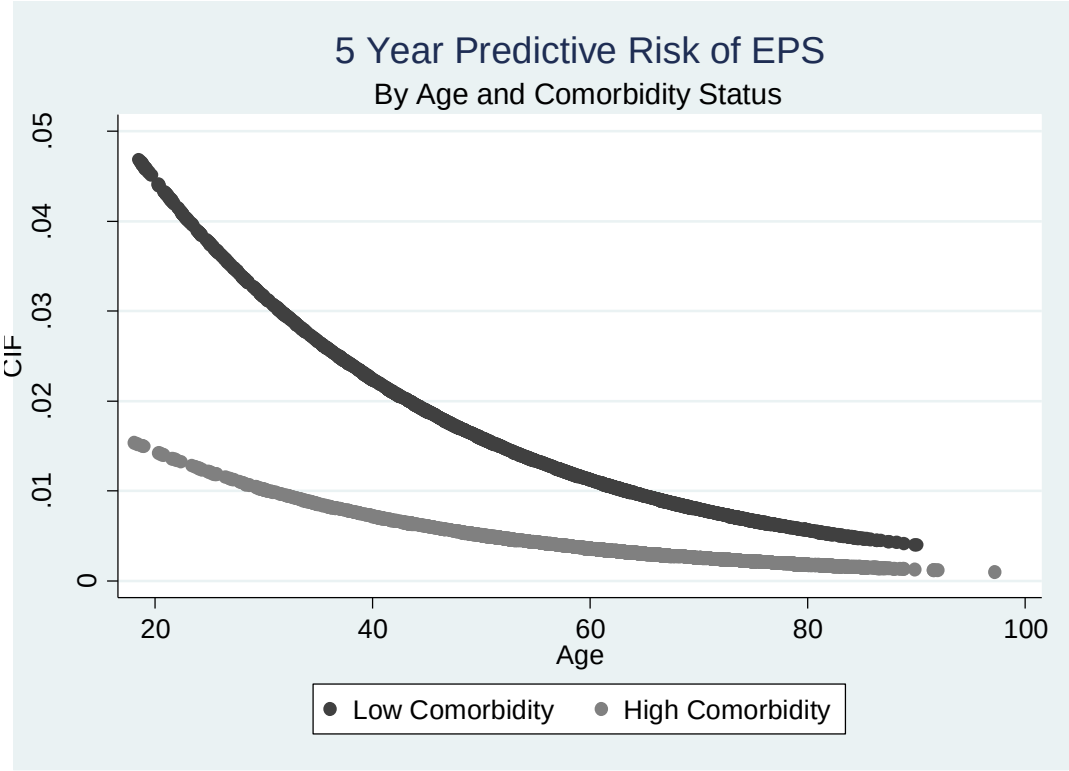
INTErnational **G**roup **R**esearch **A**ssessing **T**ransition **E**ffects in **D**ialysis

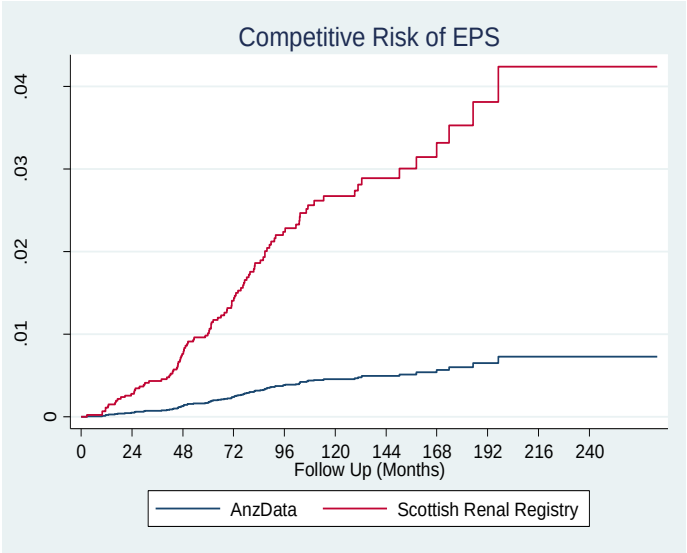
Use quantitative and qualitative research to better manage and predict the benefits of modality transition

- Canada (Chan, Perl, Nadeau-Fredette), Australia (Johnson, Tong), Europe (Van Biesen, Lambie, Jager, Davies)


Tx
Dialysis Decision Aid
CKD
PD
CAPD,
APD,
aAPD
HD
CBHD
HHD
Con Care
UK-Cath
PDOPPS
PDCRAFT

PD-CRAFT – PHASE 1.
DEVELOPING A COMPETING RISKS MODEL FOR EPS RISK





PD-CRAFT:

landmarking approach for dynamic prediction of competing risks using calendar time

All patients had 3 years PD		EPS Risk	Death Risk
Australian Cohort N=16,267	Aged 40, low risk PRD, non-diabetic	0.0196	0.278
	Aged 60 , low risk PRD, non-diabetic	0.0118	0.408
	Aged 80, high risk PRD, diabetic	0.00354	0.875
Scottish Cohort N=1237	Aged 40, low risk PRD, non-diabetic	0.135	0.195
	Aged 60 , low risk PRD, non-diabetic	0.0832	0.295
	Aged 80, high risk PRD, diabetic	0.0257	0.751

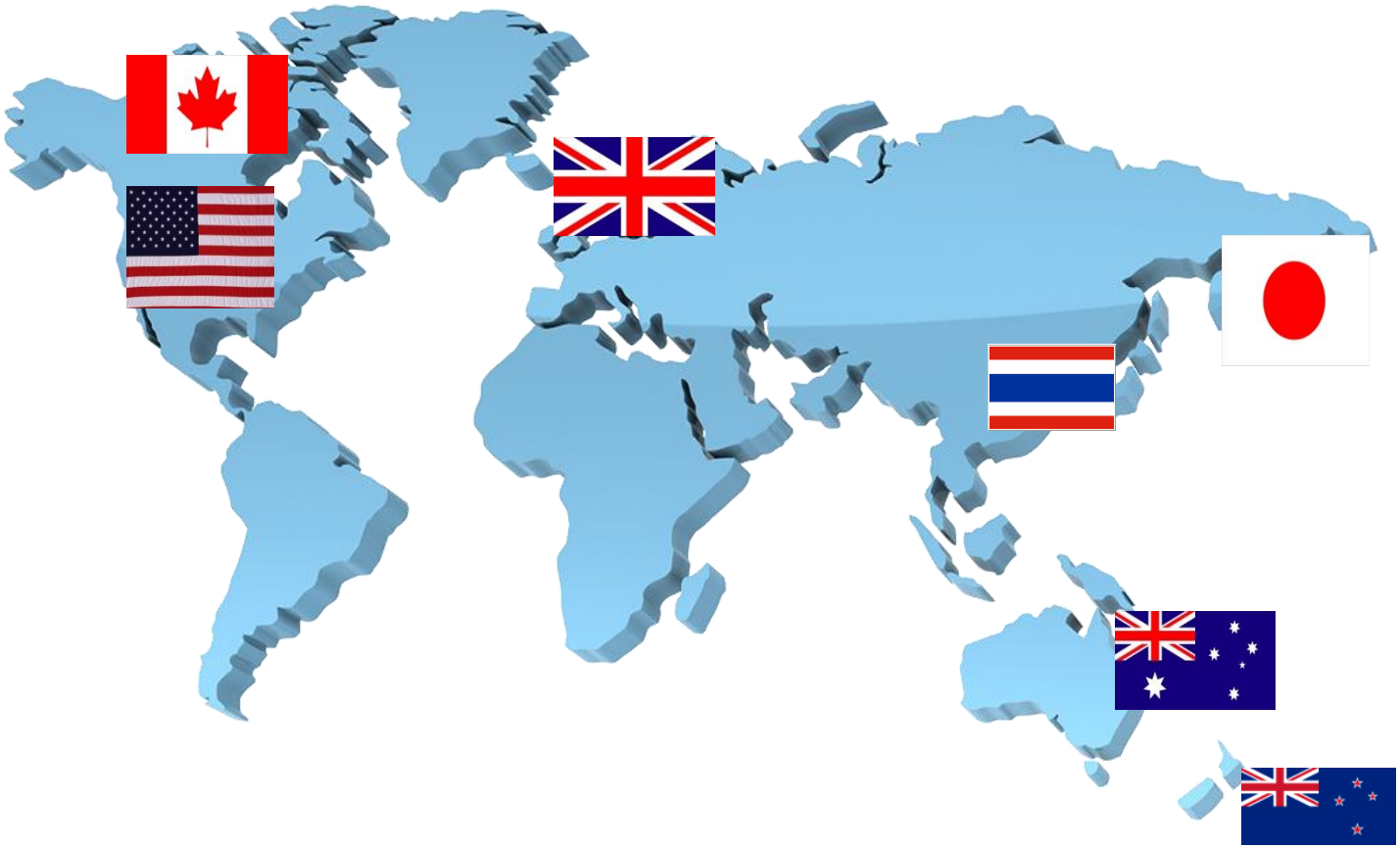
On **internal** validation, both EPS and death models showed good discrimination (C-statistics for EPS 0.90 – 0.91, for death 0.80 – 0.81). Calibration plots were satisfactory.

PDOPPS

Peritoneal Dialysis Outcomes and Practice Patterns Study

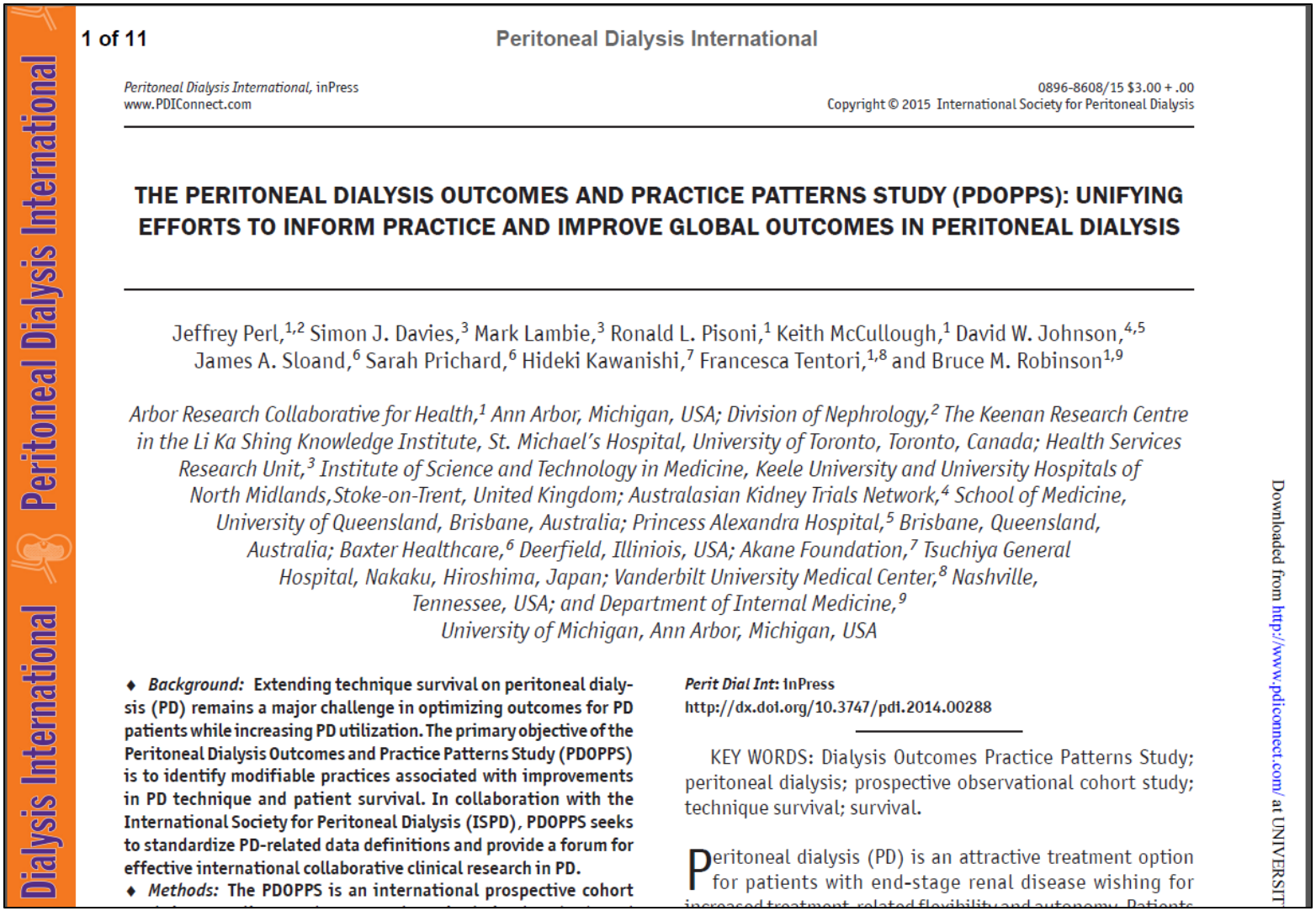
An update

PDOPPS Map in 2016



PDOPPS

PDOPPS Methods Paper



Peritoneal Dialysis International

Peritoneal Dialysis International, inPress
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THE PERITONEAL DIALYSIS OUTCOMES AND PRACTICE PATTERNS STUDY (PDOPPS): UNIFYING EFFORTS TO INFORM PRACTICE AND IMPROVE GLOBAL OUTCOMES IN PERITONEAL DIALYSIS

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Arbor Research Collaborative for Health,[1] Ann Arbor, Michigan, USA; Division of Nephrology,[2] The Keenan Research Centre in the Li Ka Shing Knowledge Institute, St. Michael's Hospital, University of Toronto, Toronto, Canada; Health Services Research Unit,[3] Institute of Science and Technology in Medicine, Keele University and University Hospitals of North Midlands, Stoke-on-Trent, United Kingdom; Australasian Kidney Trials Network,[4] School of Medicine, University of Queensland, Brisbane, Australia; Princess Alexandra Hospital,[5] Brisbane, Queensland, Australia; Baxter Healthcare,[6] Deerfield, Illiniois, USA; Akane Foundation,[7] Tsuchiya General Hospital, Nakaku, Hiroshima, Japan; Vanderbilt University Medical Center,[8] Nashville, Tennessee, USA; and Department of Internal Medicine,[9] University of Michigan, Ann Arbor, Michigan, USA

♦ ***Background:*** **Extending technique survival on peritoneal dialysis (PD) remains a major challenge in optimizing outcomes for PD patients while increasing PD utilization. The primary objective of the Peritoneal Dialysis Outcomes and Practice Patterns Study (PDOPPS) is to identify modifiable practices associated with improvements in PD technique and patient survival. In collaboration with the International Society for Peritoneal Dialysis (ISPD), PDOPPS seeks to standardize PD-related data definitions and provide a forum for effective international collaborative clinical research in PD.**

♦ ***Methods:*** **The PDOPPS is an international prospective cohort**

***Perit Dial Int*: inPress**
http://dx.doi.org/10.3747/pdi.2014.00288

KEY WORDS: Dialysis Outcomes Practice Patterns Study; peritoneal dialysis; prospective observational cohort study; technique survival; survival.

Peritoneal dialysis (PD) is an attractive treatment option for patients with end-stage renal disease wishing for

Perit Dial Int. 2015. [Epub ahead of print]

Patient Characteristics*

Characteristic	United States	Australia	Canada	Japan
# of facilities	68	12	20	27
# of Selected patients	1728	184	387	492
Demographics				
Male	54%	63%	57%	63%
Age, years				
<45	19%	11%	13%	7%
45-59	30%	20%	28%	25%
60-74	37%	45%	38%	44%
75+	14%	24%	21%	24%
Body Mass Index	28.6(6.8)	28.1(5.6)	27.5(5.7)	23.3(3.3)
Comorbidities				
Primary Cause of ESRD				
Diabetes	36%	29%	37%	31%
Glomerulonephritis	13%	23%	21%	33%
Other	51%	48%	42%	35%
Coronary Heart Disease	25%	34%	29%	18%
Diabetes	49%	43%	45%	37%

* Preliminary data as of January, 2016; results are shown as mean (standard deviation), %. FRN 0 only.

PDOPPS

Variations in PD prescriptions – early PDOPPS data

Variable	Australia (N=134)	Canada (N=361)	Japan (N=339)	US (N=472)
Demographics				
Patient age, years	65.4(14.2)	61.7(14.5)	65.0(12.7)	58.0(15.9)
Male gender	63%	57%	63%	56%
Black race	0%	4.9%	0%	27.1%
Body weight, kg	78.8(20.9)	77.6(18.2)	60.4(11.2)	83.3(22.9)
Dialysis vintage, years	2.38(2.91)	3.25(3.73)	3.37(3.95)	3.40(4.15)
Diabetes	45%	45%	41%	47%
Continuous Ambulatory Peritoneal Dialysis (CAPD)				
CAPD	41%	30%	69%	21%
CAPD exchanges, N				
≤3	40%	28%	39%	12%
4	54%	66%	57%	79%
≥5	6%	6%	4%	9%
CAPD prescribed volume, L	6.9(2.4)	6.9(2.7)	5.6(2.0)	8.5(2.0)
CAPD day time dwell volume, L	1.99(0.23)	1.97(0.35)	1.62(0.35)	2.09(0.36)
CAPD long exchange dwell volume, L	1.98(0.34)	1.95(0.30)	1.63(0.32)	2.11(0.36)
CAPD long exchange icodextrin use	100%	77%	60%	22 %

Variable	Australia (N=134)	Canada (N=361)	Japan (N=339)	US (N=472)
Automated Peritoneal Dialysis (APD)				
APD	65%	73%	35%	83%
Wet Day	56%	66%	52%	66%
APD Cycles, N				
≤3	5%	8%	41%	16%
4	27%	38%	33%	45%
5	42%	34%	14%	31%
≥6	26%	20%	12%	13%
APD daytime exchanges, N				
0 (Dry Day)	55%	36%	50%	49%
≥1	45%	64%	50%	51%
APD wet day any icodextrin use	86%	81%	61%	46%
APD prescribed volume, L	11.2(3.4)	11.4(3.6)	7.13(2.92)	11.8(3.4)
APD daytime dwell volume, L	1.52(0.52)	1.60(0.52)	1.52(0.47)	1.53(0.60)
APD cycle dwell volume, L	2.00(0.51)	2.12(0.41)	1.73(0.47)	2.16(0.41)
Residual kidney function				
Urine volume in 24 hours, L	1.11(0.84)	0.88(0.65)	0.80(0.63)	0.72(0.75)
Total Kt/V				
<1.7	16%	39%	45%	13%
1.7-2.0	24%	15%	18%	26%
≥2.0	60%	46%	37%	61%
Total prescribed PD volume , L	10.0(4.2)	10.9(4.5)	6.3(2.7)	11.5(3.7)
per body mass index	0.37(0.16)	0.41(0.18)	0.28(0.12)	0.41(0.16)
per body surface area	0.09(0.04)	0.10(0.04)	0.07(0.03)	0.10(0.03)

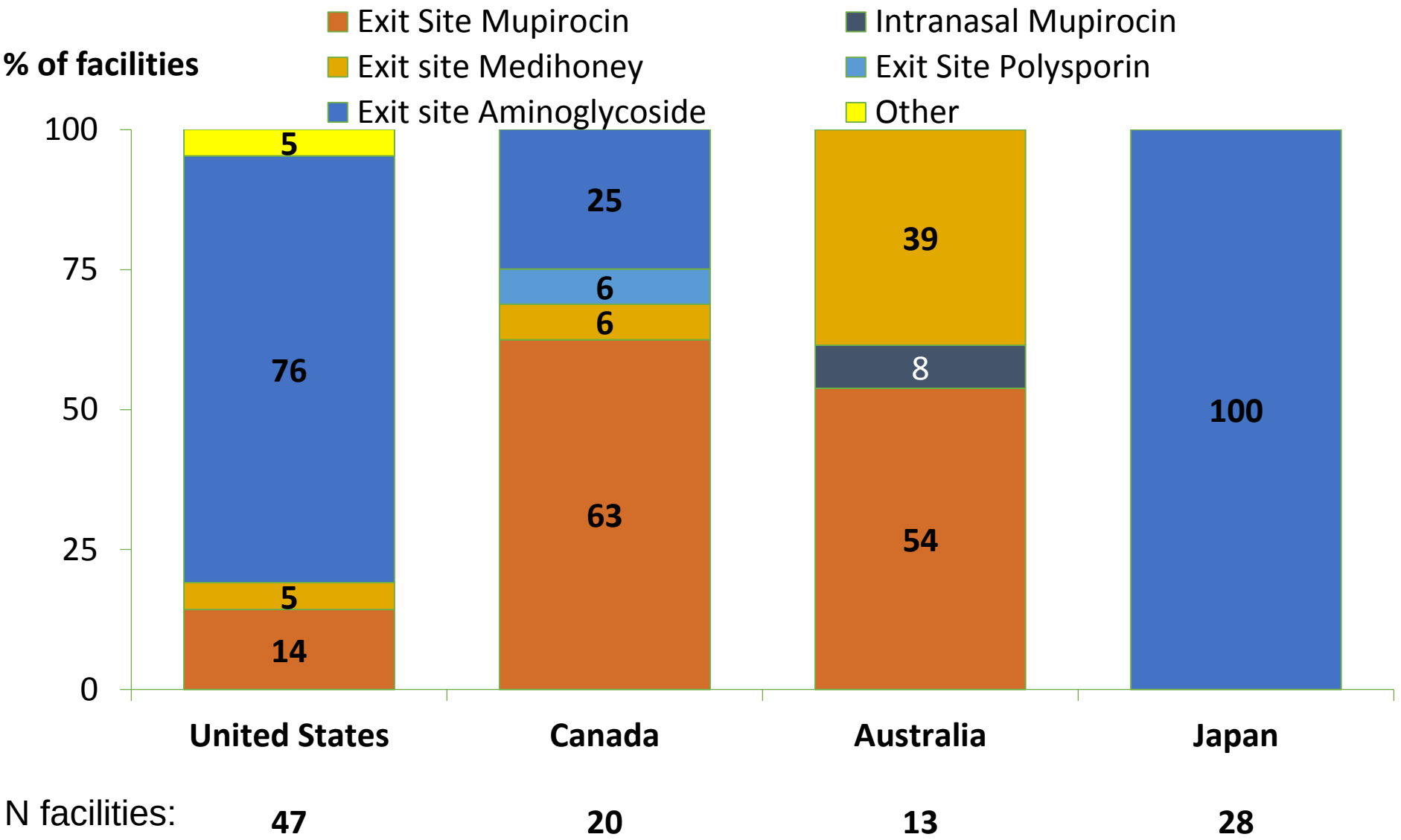
PD Dose Adjusted for BMI and BSA

Variable	US (N=508)	Australia (N=171)	Canada (N=366)	Japan (N=438)
Total prescribed PD volume , L	11.6(4.1)	10.8(4.8)	10.9(4.5)	6.6(2.9)
Per body mass index	0.43(0.19)	0.41(0.18)	0.40(0.18)	0.28(0.12)
Per body surface area	6.03(2.36)	5.99(2.60)	5.74(2.23)	4.00(1.57)

* Preliminary data as of January, 2016; results are shown as mean (standard deviation), median [IQR], %

Davies et al. EDTA abstract (2016)

Exit Site Antimicrobial Prophylaxis



* Preliminary data as of January, 2016;

Medical Director Survey (MDS)

International Variations of Patient-Reported Quality of Life from the PDOPPS (Unadjusted)

	US (n=616)	Japan (n=354)	Canada (n=224)	p-value[a]
Kidney Disease Quality of Life (KDQOL) Measures				
Mean physical component summary (PCS) score	37.6	45.8	37.0	<0.01
Mean mental component summary (MCS) score	48.7	46.6	48.6	0.05
% with a lot of limitation doing moderate activities	26.1	11.8	29.1	<0.01
% with a lot of limitation climbing several flights of stairs	39.6	14.3	40.2	<0.01
% who accomplish less than they would like (physically) all the time	14.2	6.8	13.7	<0.01
% for whom pain does not interfere with their normal work	31.8	54.9	28.5	<0.01
% with a lot of energy all the time	2.5	9.1	3.3	0.01
Self-reported Depression				
Mean CES-D[b] score	7.18	8.73	7.48	<0.01
% with CES-D[b] score ≥ 10	29.0	40.5	31.4	0.01

Preliminary data as of January, 2016;

a. Testing the null hypothesis that all three countries have the same crude patient reported outcome measures.

b. Center for Epidemiologic Studies Depression (CES-D)

Finkelstein et al. EDTA abstract (2016)

Final Reflections and Conclusions

- PD will always be a major player in home dialysis – and survival is now competitive with HD
- Residual renal function should be preserved – in my view over and above other surrogate outcome measures
- Technique failure remains the greatest challenge
- Working together is crucial to change this – and this is happening