# **Peritoneal Dialysis**

#### Dr Kamal Sud

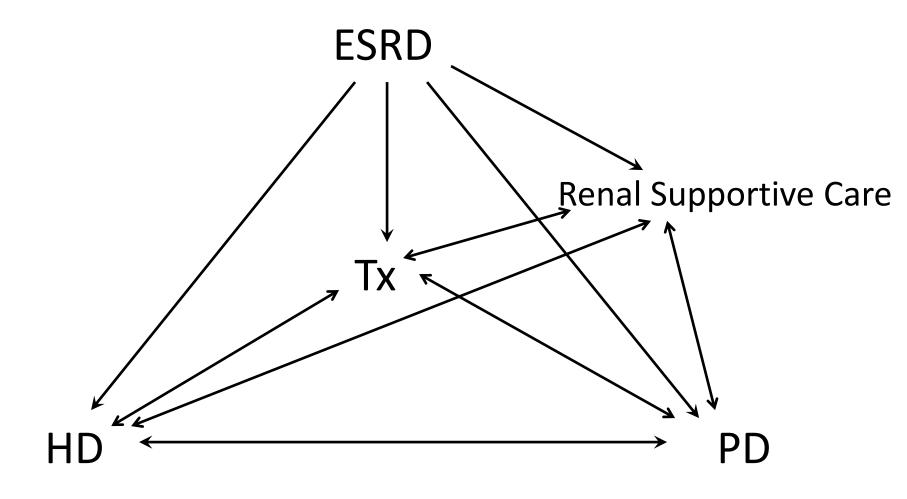
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Clinical Associate Professor - University of Sydney (Nepean Clinical School)

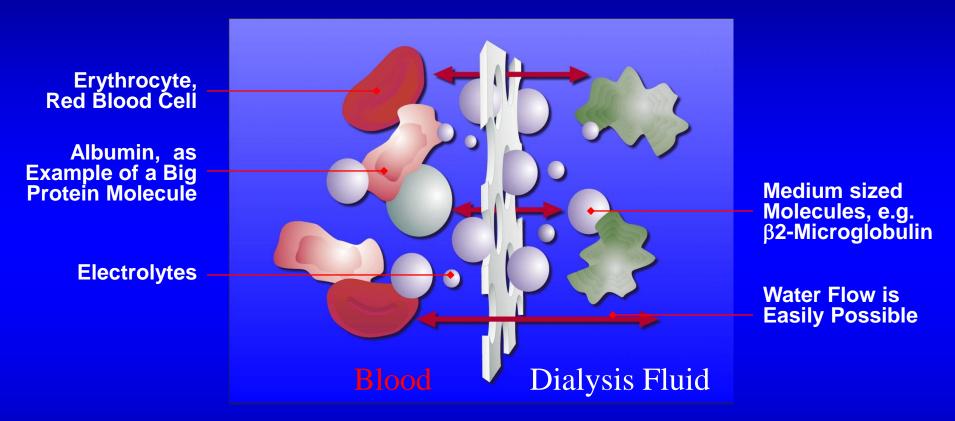




### ESRD – Integrated Care and Options



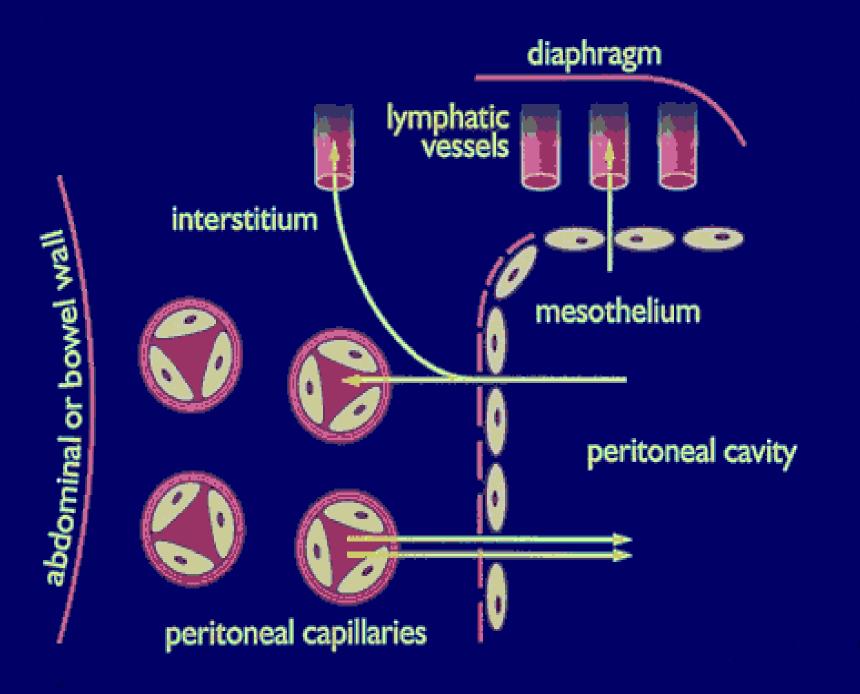
#### Principles of Dialysis: Diffusion and Ultrafiltration across a Semipermeable Membrane



The semi permeable membrane functions similar to a fine sieve, only molecules that are small enough can pass.

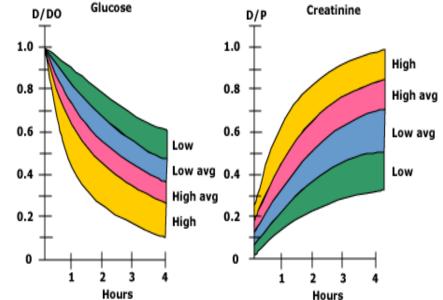
# **Peritoneal dialysis**

Blood Side	Dialysate Side
RBC	
WBC	PD Fill Volume 2L, 2.5L, 3L
Urea	Dwell Time
Creatinine	
Phosphate	<b>_</b>
Sodium	PD
Potassium	- Lactate -Bicarb
Magnesium	-Dicard
pH 🗕	
Water	



# PERITONEAL EQUILIBRATION TEST

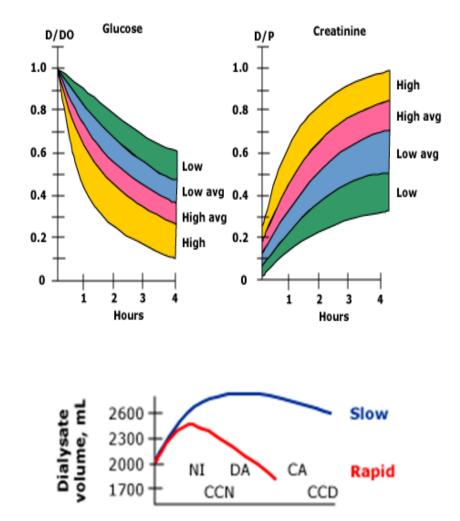
- Gives us an idea of the transport characteristics of an individual's peritoneal membrane.
- Assessed by using equilibration ratios between dialysate and plasma for urea (D/P urea), creatinine (D/P creatinine) ...
- By waiting for equilibration, this test measures the combined effect of diffusion and ultrafiltration.



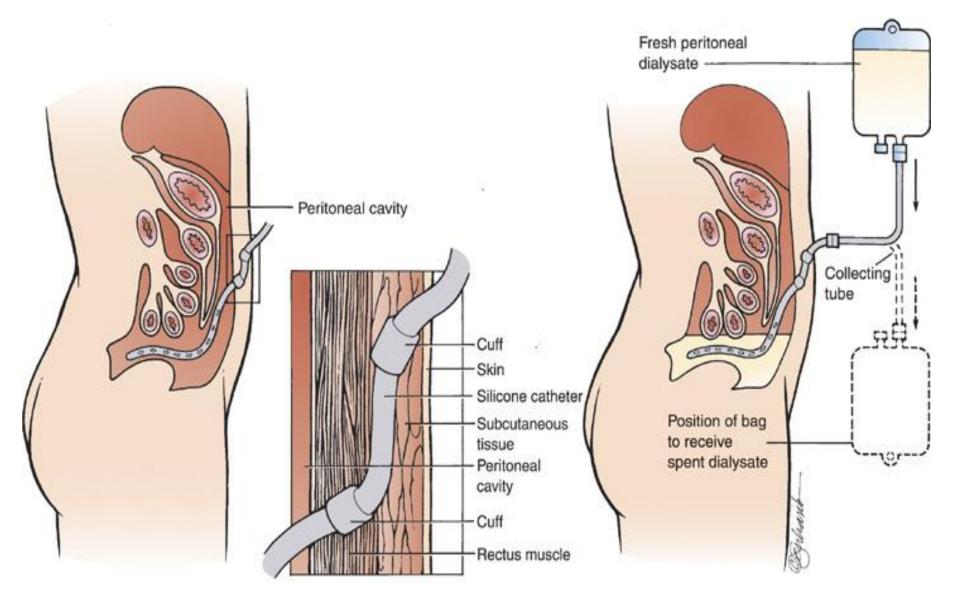
UF volumes are inversely proportional to peritoneal transport characteristics for solutes

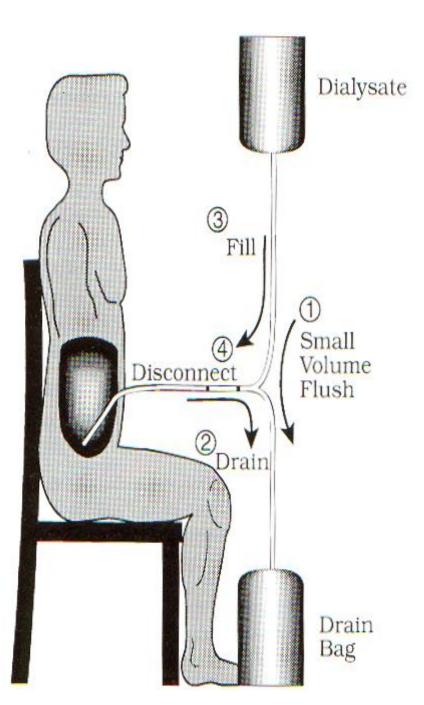
High transporters rapidly absorb the osmotic agent into peritoneal capillaries, diminishing stimulus for ultrafiltration within a few hours of dwell. After equilibration is achieved, because of reabsorption of fluid through the lymphatics, the UF volume comes down with time.

Low transporters have good ultrafiltration, because the osmotic gradient is maintained throughout the entire dwell.



## **Peritoneal Dialysis Access**

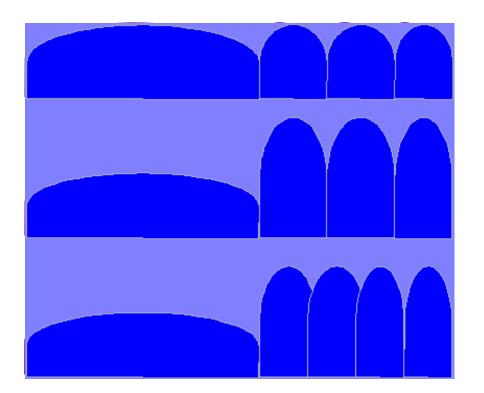




4 times per day
(2-3L exchanges
20-30 minutes out
5-10 minutes in)

• 7 days a week

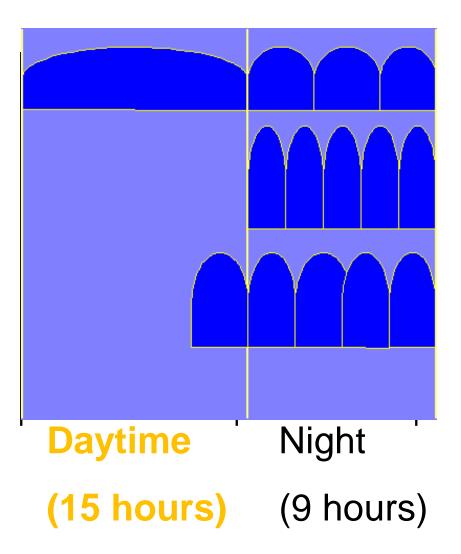
### CAPD-Continuous Ambulatory Peritoneal Dialysis



#### **Standard CAPD**

NightDay(9 hours)(15 hours)

### Continuous Cyclic PD and Nocturnal Intermittent PD



#### Standard CCPD

### NIPD

NIPD with an increased time on cycler (or manual exchange, or prolonged night PD)

### CAPD vs APD

#### Complications expressed as episodes per patient-year.

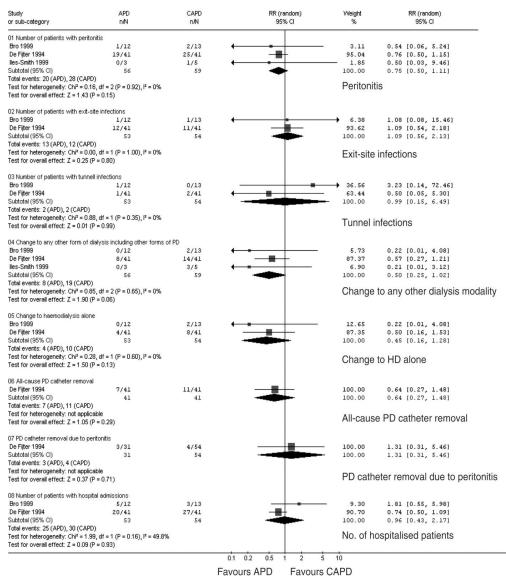
Study or sub-category	Log [rate ratio] (SE)		Rate ratio (ra 95% C	-	Weight %	Rate ratio (random) 95% Cl
01 Peritonitis episodes pe De Fijter 1994	rpatient-year -0.6162 (0.2236)				96.77	0.54 [0.35, 0.84]
Bro 1999	-0.5978 (1.2247)	←			→ 3.23	0.55 [0.05, 6.07]
Subtotal (95% Cl)					100.00	0.54 [0.35, 0.83]
Test for heterogeneity: Ch Test for overall effect: Z =	i² = 0.00, df = 1 (P = 0.99), l² = 0% : 2.80 (P = 0.005)				Peritonitis	s episodes per patient-year
02 Exit-site infection episo	des per patient-year					
De Fijter 1994	-0.0100 (0.2966)			>	95.79	0.99 [0.55, 1.77]
Bro 1999	0.1248 (1.4142)				→ 4.21	1.13 [0.07, 18.11]
Subtotal (95% Cl)					100.00	1.00 [0.56, 1.76]
Test for heterogeneity: Ch Test for overall effect: Z =	i² = 0.01, df = 1 (P = 0.93), l² = 0% : 0.01 (P = 0.99)				Exit-site i	nfection episodes per patient-year
03 Hospitalisation episode			_			
De Fijter 1994	-0.5108 (0.2236)				100.00	0.60 [0.39, 0.93]
Subtotal (95% Cl)	• <sup>1</sup>				100.00	0.60 [0.39, 0.93]
Test for heterogeneity: no Test for overall effect: Z =					Hospitalis	ation episodes per patient-year
		0.2	0.5 1	2	5	
		Favou	irs APD F	avours CA	PD	

Kannaiyan S. Rabindranath et al. Nephrol. Dial. Transplant. 2007;22:2991-2998

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### CAPD vs APD



Impact of PD modality on various clinically important outcomes.

No differences in number of patients with exit site infections, tunnel infections.

No difference in technique survival



Kannaiyan S. Rabindranath et al. Nephrol. Dial. Transplant. 2007;22:2991-2998

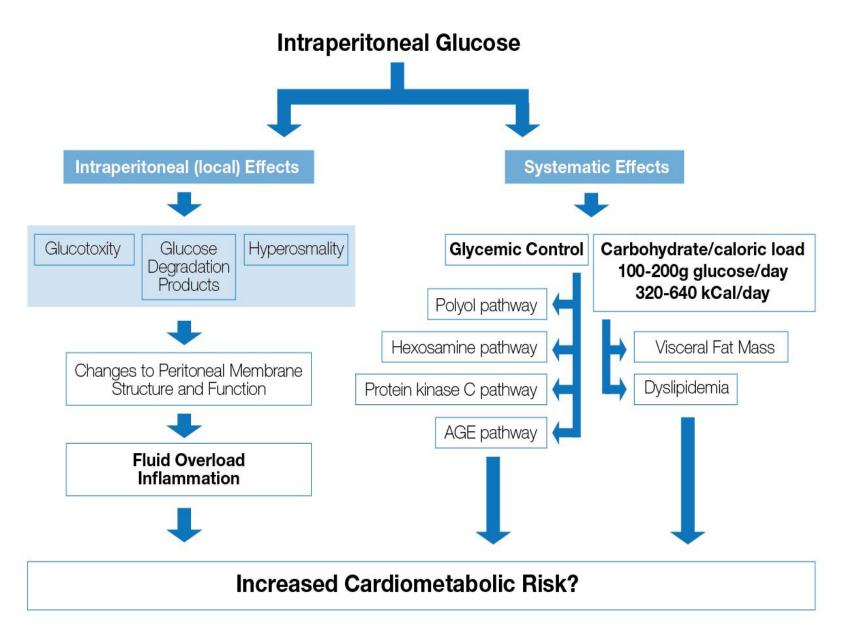
### Currently available PD solutions

Table 1   Selecte	d perito	oneal dialysis	solutions cur	rently available ir	Europe		
Solution (manufacturer)	рН	Chambers	Buffer	Osmotic agent	GDPs	Advantages	Disadvantages
Dianeal® (Baxter*)	5.2	Single	Lactate	Glucose	High	Easy to manufacture; low cost	Low pH; poor peritoneal membrane biocompatibility; infusion pain; contains lactate
Extraneal® (Baxter*)	5.6	Single	Lactate	Icodextrin	Low	Sustained ultrafiltration; reduced hyperglycemia; improved metabolic profile and body composition	Contains lactate; low pH; single daily use only; hypersensitivity
Nutrineal® (Baxter*)	5.5	Single	Lactate	Amino acids	No	Avoids glucose exposure; peritoneal membrane protection; enhanced nutrition	Contains lactate; low pH; single daily use only
Physioneal® (Baxter*)	7.4	Double	Lactate/ bicarbonate	Glucose	Low	Improved biocompatibility; preserved membrane defense; reduced infusion pain	Local and systemic glucose exposure; reduced peritoneal lactate exposure
Stay-safe® (Fresenius‡)	5.5	Single	Lactate	Glucose	High	Ease of manufacture; low cost	Low pH; poor peritoneal membrane biocompatibility; infusion pain; contains lactate
Balance® (Fresenius‡)	7.0	Double	Lactate	Glucose	Low	Improved biocompatibility; preserved membrane defense; reduced risk of peritonitis?	Higher but not neutral pH; local and systemic glucose exposure; contains lactate
BicaVera® (Fresenius‡)	7.4	Double	Bicarbonate	Glucose	Low	Improved biocompatibility; preserved membrane defense; improved correction of acidosis	Local and systemic glucose exposure
Gambrosol® Trio (Fresenius‡)	6.5	Triple	Lactate	Glucose	Low	Improved biocompatibility; preserved membrane defense	Higher but not neutral pH; local and systemic glucose exposure; contains lactate

\*Deerfield, IL, USA. \*Bad Homburg, Germany. Abbreviation: GDPs, glucose degradation products.

García-López, E. *et al.* (2012) An update on peritoneal dialysis solutions *Nat. Rev. Nephrol.* doi:10.1038/nrneph.2012.13

### **NEVIEWS** NEPHROLOGY



CJ Holmes, 2009

# 7.5% Icodextrin

Relatively inert high molecular weight polymaltose glucose polymer

- Less permeable than dextrose ultrafiltration occurs for a longer period of time.
- Equivalent UF volume as a 4.25% dextrose
- Best used in a long dwell
- Reduced carbohydrate load

Potential advantage of reducing the long term metabolic complications associated with hypertonic dextrose

# Icodextrin

Some glucometers measure non-glucose sugars (e.g. icodextrin metabolite -Maltose): Falsely elevated readings.

Glucometers based on glucose dehydrogenase pyrroloquinolone quinone OR glucose dehydrogenase flavin-adenine dinucleotide cannot distinguish between glucose vs. maltose

#### www.glucosesafety.com

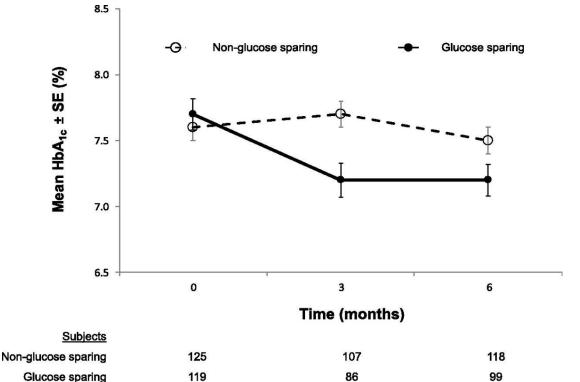
Maltose metabolites with icodextrin do not return to baseline until 2 weeks after cessation.

	Updated 6 <sup>th</sup> Nov, 201	9	
Glucose Monitor Brand	Compatible with	Test Type*	Manufacturer
	Extraneal (Icodextrin)		
	PD solution (Glucose-		
	specific)		
FreeStyle Freedom	Yes	GDH-FAD	
FreeStyle Freedom Lite	Yes	GDH-FAD	Abbott Diabetes Care
FreeStyle Lite	Yes	GDH-FAD	www.abbottdiabetescare.c
FreeStyle Libre <sup>1</sup>	Not recommended	GO	om
FreeStyle Libre Pro <sup>1</sup>	Not recommended	GO	Phone: 1800 801 478
FreeStyle Optium Neo	Yes	GDH-NAD	
FreeStyle Optium Neo H	Yes	GDH-NAD	
FreeStyle Papillon Vision	Yes	GDH-FAD	
FreeStyle Precision Neo	Yes	GDH-NAD	
FreeStyle Precision Pro	Yes	GDH-NAD	
Optium Xido Neo	Yes	GDH-NAD	
Precision Xceed Pro	Yes	GDH-NAD	
Assure Platinum	Ves	60	

Under estimation of Serum amylase level

### PD Fluids with Low Glucose exposure

Mean HbA1c (±SEM) at baseline, month 3, and end of study by treatment group in the intention-to-treat population.



Serum triglyceride, very-low-density lipoprotein, and apolipoprotein B levels improved in the intervention group. Deaths and serious adverse events, including several related to extracellular fluid volume expansion were significantly high in the intervention group.



# Effect of icodextrin on uncontrolled fluid overload episodes.

	Glucose po	lymer	Contr	ol		Risk Ratio	Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% C	I M-H, Random, 95% Cl
2.4.1 12 months							
Paniagua 2009	5	30	17	29	64.5%	0.28 [0.12, 0.67	
Subtotal (95% CI)		30		29	64.5%	0.28 [0.12, 0.67	
Total events	5		17				
Heterogeneity: Not ap	plicable						
Test for overall effect:	Z = 2.88 (P =	0.004)					
2.4.2 24 months							
Takatori 2011	3	21	9	20	35.5%	0.32 (0.10, 1.01	]
Subtotal (95% CI)		21		20	35.5%	0.32 [0.10, 1.01	
Total events	3		9				
Heterogeneity: Not ap	plicable						
Test for overall effect:	Z = 1.95 (P =	0.05)					
Total (95% Cl)		51		49	100.0%	0.30 [0.15, 0.59	↓ ◆
Total events	8		26				
Heterogeneity: Tau² =	0.00; Chi <sup>2</sup> =	0.02, df=	= 1 (P = 0	.88); l²	= 0%		
Test for overall effect:	Z = 3.47 (P =	0.0005)					Favours experimental Favours control
Test for subgroup diff	erences: Chi	<sup>2</sup> = 0.02.	df = 1 (P	= 0.88)	. I² = 0%		r avours experimentar i r avours control

Yeoungjee Cho et al. Nephrol. Dial. Transplant. 2013;28:1899-1907



### Icodextrin vs Glucose: Effect on Mortality

	ICO		GLU	J		Peto Odds Ratio	Peto Odds Ratio	Risk of Bias
Study or Subgroup	Events	Total			Weight	Peto, Fixed, 95% Cl	Peto, Fixed, 95% CI	ABCDEFG
1.1.1 ≤ 6 weeks								
Bredie 2001	0	11	0	11		Not estimable		???? 🗣 ? 🖶 🕈
Chow 2014	0	23	0	33		Not estimable		••?•?•
Finkelstein 2005	0	47	0	45		Not estimable		
Lin 2009	1	98	0	103	3.7%	7.78 [0.15, 392.35]		- ••••••?•
Ota 2003	0	26	0	28		Not estimable		? • • • • ? •
Wolfson 2002A	0	90	0	85		Not estimable		
Yu 2002	0	22	0	22		Not estimable		? 🛨 ? 🛨 🛨 ? 🛨
Subtotal (95% CI)		317		327	3.7%	7.78 [0.15, 392.35]		-
Total events	1		0					
Heterogeneity: Not ap	plicable							
Test for overall effect:	Z = 1.03 (	(P = 0.3)	31)					
1.1.2 3-6 months								
Davies 2003	0	27	0	21		Not estimable		
de Moraes 2015	0	33	1	27	3.7%	0.11 [0.00, 5.57]		
Konings 2003	0	22	0	18		Not estimable		<b>? • ? • ? ? •</b>
Mistry 1994	0	106	2	103	7.4%	0.13 [0.01, 2.10]		$\bullet \bullet ? \bullet ? ? \bullet$
Plum 2002	1	20	0	19	3.7%	7.03 [0.14, 354.68]		- • ? • • • ? •
Subtotal (95% CI)		208		188	14.7%	0.34 [0.05, 2.42]		
Total events	1		3					
Heterogeneity: Chi <sup>2</sup> =		· ·		= 35%				
Test for overall effect:	Z = 1.08 (	(P = 0.2)	(8)					
1.1.3 1-2 years								
Chang 2016	1	49	0	51	0.0%	7.70 [0.15, 388.20]		
Chen 2018	1	21	0	22	3.7%	7.75 [0.15, 390.96]		- • ? ? • • ? •
Paniagua 2009	0	30	6	29	20.3%	0.11 [0.02, 0.58]		••?•?•
Posthuma 2000	0	19	5	19	16.5%	0.11 [0.02, 0.68]		? • ? • ? ? •
Takatori 2011	0	21	1	20	3.7%	0.13 [0.00, 6.50]		????
Wolfson 2002B	7	175	4	112	37.4%	1.12 [0.33, 3.85]	<b>_</b>	•••••??•
Yoon 2014	1	41	1	39	0.0%	0.95 [0.06, 15.48]		? 🛨 ? 🛨 🛨 ? 🛨
Subtotal (95% CI)		266		202	81.6%	0.39 [0.17, 0.89]	◆	
Total events	8		16					
Heterogeneity: Chi <sup>2</sup> =	9.51, df=	4 (P =	0.05); l <sup>2</sup> =	= 58%				
Test for overall effect:	Z=2.24 (	(P = 0.0)	13)					
Total (95% CI)		791		717	100.0%	0.42 [0.20, 0.90]		
	40	791	4.0	111	100.0%	0.42 [0.20, 0.90]	-	
Total events	10	- 0 (75	19	- 40~				
Heterogeneity: Chi <sup>2</sup> =				= 46%	)		0.001 0.1 1 10 10	000
Test for overall effect:			,	2 (D	0.000 17-	0.70	Favours ICO Favours GLU	
Test for subgroup diff	erences:	Unr=	z.zz, af =	∠ (P =	0.33), 1* =	9.770		

### Icodextrin use on other clinical outcomes

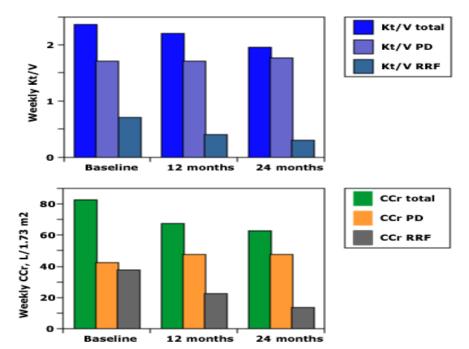
- No impact on
  - Technique survival
  - Residual renal function
  - Urine output
  - Incidence of peritonitis

Yeoungjee Cho et al. Nephrol. Dial. Transplant. 2013;28:1899-1907

AJKD 2010: doi: 10.1053/j.ajkd.2019.10.004

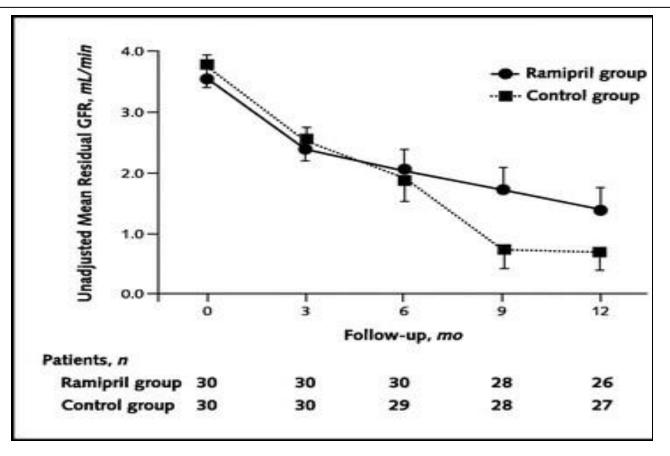
# Importance of RRF

- Solute clearance
- Benefits of maintaining RRF
  - Anaemia
  - Fluid management
  - BP and LVH
  - Patient survival



Increasing urine output with diuretics increases free water excretion, without increasing solute excretion

Effects of an Angiotensin-Converting Enzyme Inhibitor on Residual Renal Function in Patients Receiving Peritoneal Dialysis: A Randomized, Controlled Study



Unadjusted mean residual glomerular filtration rate (GFR) at baseline and follow-up in the ramipril group and the control group.

Wolters Kluwer

Health

OvidSP © 2003 American College of Physicians. Published by American College of Physicians.

# Preservation of RRF

Use of ACEi/ARBs for treatment of hypertension Low GDP, neutral pH PD solutions

Avoid

- Prolonged use of Aminoglycosides
- NSAIDS
- Contrast agents

#### Effect of neutral-pH, low-GDP PD solutions on RRF

	Neutral-	pH, low-	GDP	Con	ventior	nal		Std. Mean Difference	Std. Mean Difference
tudy or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% Cl
ajo MA (2011)	4.2	2.6	9	4.2	4	3	1.4%	0.00 [-1.31, 1.31]	
alANZ 2012	3.4	2.79	40	3.2	2.82	48	13.9%	0.07 [-0.35, 0.49]	
ho (2013)	2.4	1.72	32	2.2	2.14	28	9.5%	0.10 [-0.41, 0.61]	
hoi HY (2008)	4.7	10.9	38	1.86	6.44	30	10.6%	0.30 [-0.18, 0.79]	
ernandez-Perpen (2012)	6	4.4	5	4.2	4	3	1.2%	0.37 [-1.09, 1.82]	
im SG (2008)	3.9	4.9	36	2.2	1.8	33	10.7%	0.45 [-0.03, 0.93]	
im YL (2003)	2.3	1.2	16	1.8	2.2	10	3.9%	0.29 [-0.50, 1.09]	
ai KN (2012)	2.3	2.74	58	1.69	2.29	67	19.7%	0.24 [-0.11, 0.59]	
ark (2012)	2.9	3.1	64	2.9	2.3	47	17.3%	0.00 [-0.38, 0.38]	
zeto (2007)	2.72	2.08	25	2.81	2.87	25	8.0%	-0.04 [-0.59, 0.52]	
/eiss (2009)	4.77	3.78	15	4.1	2.8	11	4.0%	0.19 [-0.59, 0.97]	· · · · · ·
otal (95% CI)			338			305	100.0%	0.17 [0.01, 0.32]	•
leterogeneity: Tau <sup>2</sup> = 0.00;	$Chi^{2} = 3.5$	8. df = 1	0 (P = 0)	.96): I <sup>2</sup>	= 0%			-2	ti

	Neutral-	pH, low-	-GDP	Con	ventio	nal		Std. Mean Difference	Std. Mean Difference			ice	
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI		IV, Ra	andom, 95%	CI	
Bajo MA (2011)	6.9	4.2	11	3.4	2.5	20	11.7%	1.07 [0.28, 1.86]				-	
balANZ 2012	5.9	3.25	76	5.1	3.08	75	24.9%	0.25 [-0.07, 0.57]					
Cho (2013)	3.29	2.61	32	1.97	1.64	28	18.3%	0.59 [0.07, 1.11]					
Choi HY (2008)	5.7	11	44	5.7	11	47	21.8%	0.00 [-0.41, 0.41]			-+-		
Fernandez-Perpen (2012)	7.2	4.1	11	3.4	2.5	20	11.5%	1.18 [0.38, 1.98]				_	
Weiss (2009)	4.77	3.78	15	4.1	2.8	11	11.9%	0.19 [-0.59, 0.97]					
Total (95% CI)			189			201	100.0%	0.45 [0.11, 0.79]			•		
Heterogeneity: $Tau^2 = 0.09$	; Chi <sup>2</sup> = 11	.42, df =	5(P = 0)	).04); I <sup>2</sup>	= 56%	:			- t-	- L		-	- 1
Test for overall effect: Z = 2			1000 A						-4 Fav	-2 ors [Conventi	0 onal] Favors	Z [Low-GDF	y 4

#### С

	Neutral-	pH, low-	-GDP	Con	ventio	nal	9	Std. Mean Difference	Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% Cl	IV, Random, 95% CI
Bajo MA (2011)	5.5	3.7	11	4.1	3.1	18	4.8%	0.41 [-0.35, 1.17]	
balANZ 2012	4.9	2.39	62	3.9	2.82	65	22.6%	0.38 [0.03, 0.73]	<b>e</b>
Cho (2013)	2.42	1.72	32	2.22	2.14	28	10.8%	0.10 [-0.41, 0.61]	
Choi HY (2008)	4.7	10.7	38	1.86	6.44	30	12.0%	0.31 [-0.17, 0.79]	8- <b></b>
Fernandez-Perpen (2012)	5.7	3.1	11	4.1	3.1	18	4.8%	0.50 [-0.26, 1.26]	
Kim SG (2008)	3.9	4.9	36	2.2	1.8	33	12.2%	0.45 [-0.03, 0.93]	3 <b></b>
Kim YL (2003)	2.3	1.2	16	1.8	2.2	10	4.4%	0.29 [-0.50, 1.09]	
Park (2012)	2.9	3.1	64	2.9	2.3	47	19.7%	0.00 [-0.38, 0.38]	
Szeto (2007)	2.72	2.08	24	2.81	2.87	24	8.7%	-0.04 [-0.60, 0.53]	
Total (95% CI)			294			273	100.0%	0.24 [0.08, 0.41]	•
Heterogeneity: $Tau^2 = 0.00$ Test for overall effect: $Z = 3$			B (P = 0.)	78); l <sup>2</sup> =	= 0%				-2 -1 0 1 2 Favors [Conventional] Favors [Low-GDP]

Neutral-pH, low-GDP		-GDP	Conv	/entio	nal		Std. Mean Difference	Std. Mean Difference		
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% Cl	IV, Random, 95% CI	
Bajo MA (2011)	4.2	2.6	9	4.2	4	3	3.3%	0.00 [-1.31, 1.31]	22	
balANZ 2012	3.4	2.79	40	3.2	2.82	48	32.3%	0.07 [-0.35, 0.49]		
Fernandez-Perpen (2012)	6	4.4	5	4.2	4	3	2.7%	0.37 [-1.09, 1.82]	· · · · · · · · · · · · · · · · · · ·	
Kim SG (2008)	3.5	3.4	25	1.65	1.97	21	16.0%	0.64 [0.04, 1.24]	· · · · · · · · · · · · · · · · · · ·	
Lai KN (2012)	2.3	2.74	58	1.69	2.29	67	45.7%	0.24 [-0.11, 0.59]		
Total (95% CI)			137			142	100.0%	0.25 [0.01, 0.48]	•	
Heterogeneity: Tau <sup>2</sup> = 0.00	; Chi <sup>2</sup> = 2.5	i1, df = 4	(P = 0.)	64); l <sup>2</sup> =	• 0%					7
Test for overall effect: Z = 2	2.02 (P = 0.)	.04)							Favors [Conventional] Favors [Low-GDP]	2

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# Low GDP, neutral pH solutions on other outcomes

- Preserve urine output
- Less inflow pain
- No effect on:
  - Ultrafiltration volume
  - Peritoneal clearances
  - Peritonitis episodes
  - Technique failure
  - Mortality

### PD 'ADEQUACY'

#### Guidelines

#### International Society for Peritoneal Dialysis practice recommendations: Prescribing high-quality goal-directed peritoneal dialysis

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# Prescribing 'high quality goal-directed' PD

- To promote the provision of high-quality dialysis care by the dialysis team:
  - PROMs
  - Maintenance of fluid status
  - Maintenance of Nutritional Status
  - Removal of Toxins
- Shared decision making to allow the person doing PD to achieve his/her own life goals

# Peritoneal Dialysis Adequacy

#### Solute clearance:

Small solute clearances can be measured by 'Adequest Test'
'Target': weekly KT/V 1.7 (urea);
In anuric patients, additional target of creatinine clearance of 45 L/week/1.73 m2.

#### **Ultrafiltration:**

PD Fluid volume drained – infused Target: 1 Litre/day

'Goal Directed PD Prescription': Shared Decision making <a href="https://doi.org/10.1177/0896860819895364">https://doi.org/10.1177/0896860819895364</a>

# **PD- Complications**

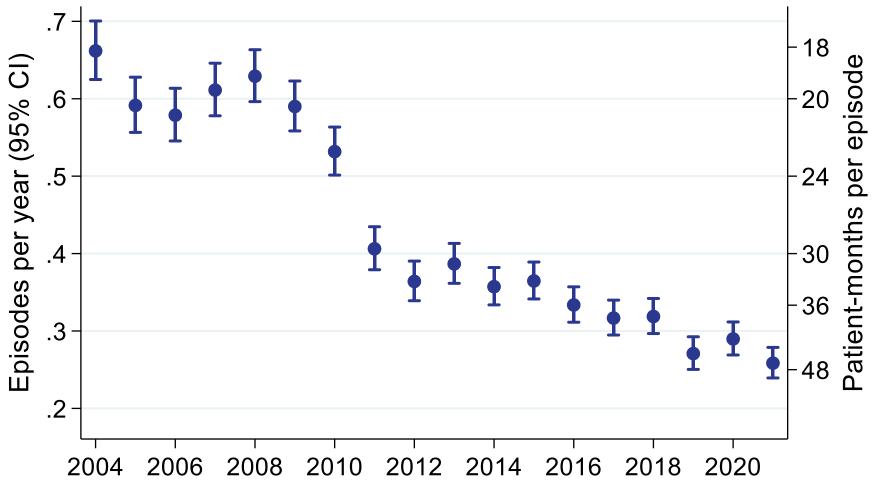
Infective Peritonitis Exit site infection **Tunnel Infection** \*Pressure related: Hernias **Dialysate leaks** Pericatheter Abd. wall Genitalia Pleural

Non-infective Access Related: Catheter obstruction **Omental entrapment** Tip migration Cuff extrusion Ultrafiltration failure Technique failure

\*Intra-abdominal Pressure lowest when supine, greatest while sitting

### PD Peritonitis Rate

Australia 2004-2021



2022 ANZDATA Annual Report, Figure 5.22



# ISPD 2022 Guidelines

### **Prevention of PD peritonitis**

We recommend that systemic prophylactic antibiotics should be administered immediately prior to catheter insertion **(1A)** 

• We recommend daily topical application of antibiotic (mupirocin or gentamicin) cream or ointment to the catheter exit-site **(1B)**.

# ISPD 2022 Guidelines: Diagnosis



- We recommend that peritonitis should always be diagnosed when at least 2 of the following are present:
  - clinical features consistent with peritonitis, i.e. abdominal pain and/or cloudy dialysis effluent;
  - dialysis effluent white cell count >100/ $\mu$ L or >0.1 x 10<sup>9</sup>/L (after a dwell time of at least 2 hours), with >50% PMN; and
  - positive dialysis effluent culture (1C).
- We recommend that PD patients presenting with cloudy effluent should be presumed to have peritonitis and treated as such until the diagnosis can be confirmed or excluded **(1C)**.

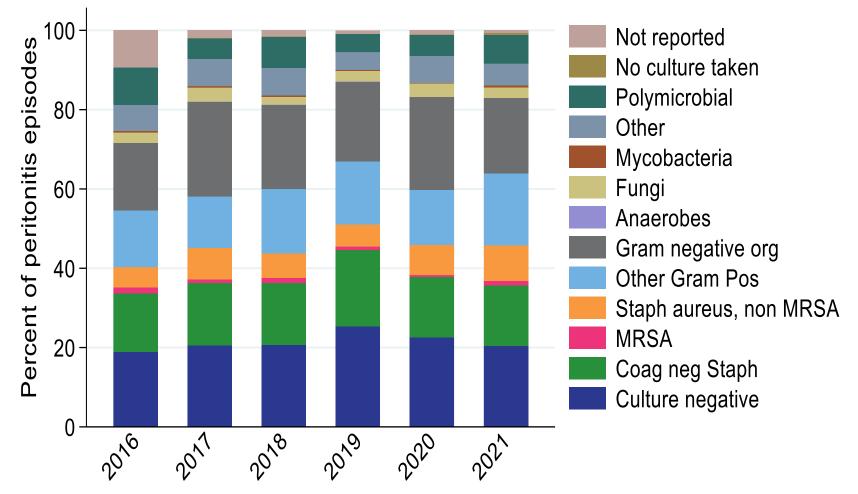
Peritoneal Dialysis International 2022, Vol. 42(2) 110–153

### **Differential Diagnosis of Cloudy Effluent**

- Culture-positive infectious peritonitis
- Infectious peritonitis with sterile cultures

- Chemical peritonitis Eosinophilia of the effluent
- Hemoperitoneum
- Malignancy (rare)
- Chylous effluent (rare)
- Specimen taken from "dry" abdomen

#### Distribution of Organisms Causing Peritonitis Australia 2016-2021



# Treatment of PD related Peritonitis

- Every hour of delay in administering antibacterial therapy from time of presentation to hospital increased the risk of PD failure or death by 6.8%
- Start empirical antibiotics ASAP
- IP administration of antibiotics better than IV
- Intermittent IP administration of antibiotics has similar response rates as continuous IP administration

Cochrane review: Treatment for peritoneal dialysis-associated peritonitis (April 2014) DOI: 10.1002/14651858.CD005284.pub KI Reports (2016) 1, 65–72; http://dx.doi.org/10.1016/j.ekir.2016.05.003

## Antibiotics and duration of treatment

Staph epi – Stept/Enterococcus:

Staph aureus:

Gram Negative: Pseudomonas:

Culture negative:

IP Cephalosporin x 2 wks **IP** Ampicillin + Gentamicin (1 week) x 2 wks MSSA: IP Cephalosprin x 3 wks MRSA: IP Vanc x 3 wks IP Aminoglycoside 2 wks 2 antibiotics, 3 wks (High rate for recurrence and relapse) **IP** Cephalosporin 2 wks

# Catheter removal: Indications

- Peritonitis with exit site/tunnel infection
- Refractory peritonitis: No improvement after
   5 days of antibiotics
- Relapsing peritonitis: Peritonitis with same organism within 4 weeks of stopping antibiotics.
- Peritonitis with intra-abdominal pathology
- Fungal / Mycobacterial peritonitis



Special Series/Guidelines

#### ISPD peritonitis guideline recommendations: 2022 update on prevention and treatment

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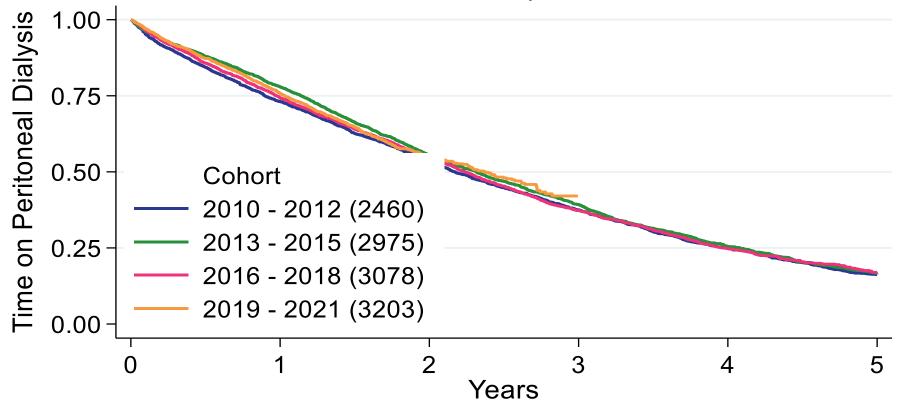
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#### Patient Survival by Era Peritoneal Dialysis within 365 days of KRT start 2010 - 2021 **Censored for Transplant - Australia** 1.00 Patient Survival 0.75 0.50 Cohort 2010 - 2012 (2460) 2013 - 2015 (2975) 0.25 2016 - 2018 (3078) 2019 - 2021 (3203) 0.00 2 3 5 0 4 Years

2022 ANZDATA Annual Report, Figure 5.10.1

#### Time on Peritoneal Dialysis by Era Peritoneal Dialysis within 365 days of KRT start

2010 - 2021 Censored for Transplant - Australia



2022 ANZDATA Annual Report, Figure 5.13.1

# Survival advantage of PD over HD? Only 2 RCTs





- Pooled data from two RCTs of 706 patients randomized equally to PD or HD
- There is an indication of 40% lower risk of death with PD
- This did not achieve statistical significance

1. Yu X, et al. 2018

2. Korevaar JC, et al. 2003

### Multiple observational studies show PD survival

#### rates outpacing HD

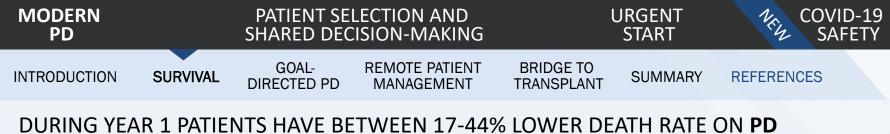
Canadian Organ Replacement Registry showed **PD** to historically have higher mortality risk compared to HD – however from **2000-4 the mortality risk equalized**<sup>2</sup> Danish Society Of Nephrology Registry has shown a consistent trend in improving **PD** mortality risk from 1990-2010<sup>3</sup>

USRDS-ESRD database has shown **PD** to have consistently better survival than HD since 2007<sup>5</sup> Korean Society of Nephrology has shown an improvement of mortality risk of **PD** over HD since 2013<sup>4</sup>

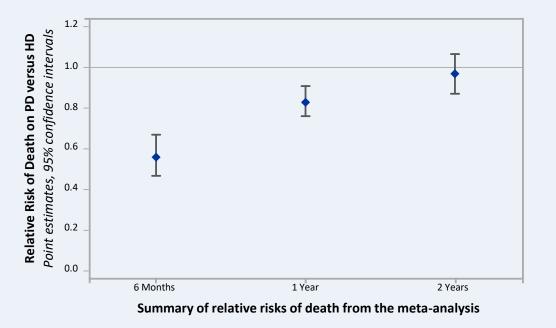
COVID-19

SAFETY

ANZ Dialysis and Transplant Registry showed HD had a **23%** improvement in mortality risk from 1998-2012 however **PD** showed a **29%** improvement in mortality from 1998-2012<sup>6</sup>



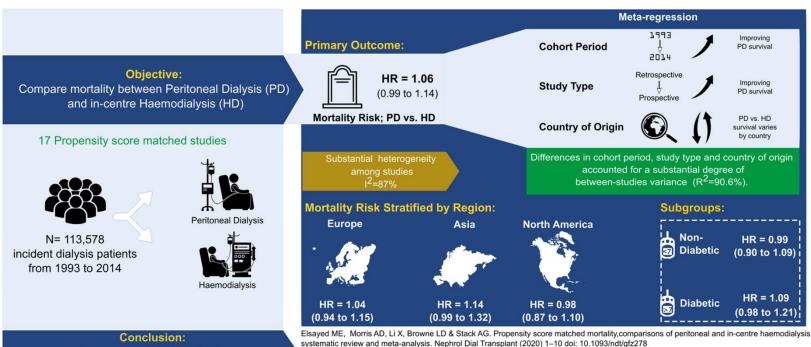
VS HD<sup>35</sup>



Meta-analysis of 811,319 patients from 18 countries: those who start dialysis with **PD** have an early survival benefit vs their counterparts who start with **HD** 

Mortality rates are significantly higher on HD than on PD through the first two years

# Mortality comparisons of peritoneal and in-centre hemodialysis



Among new dialysis patients, Peritoneal Dialysis and in-centre Haemodialysis provide equivalent survival.

Elsayed ME, et al. 2020

# Other 'Special' conditions favouring HD or PD

Condition	Favours PD	Favours HD	No Difference
CCF		Х	?
Hypoalbuminemia		Х	
Health related QOL	Х		?
Survival from critical illness in ICU		Х	
BP control	Х		
Lower ESA dose	Х		