Renal replacement therapy
腎臟替代療法

腎臟內科　王聖超

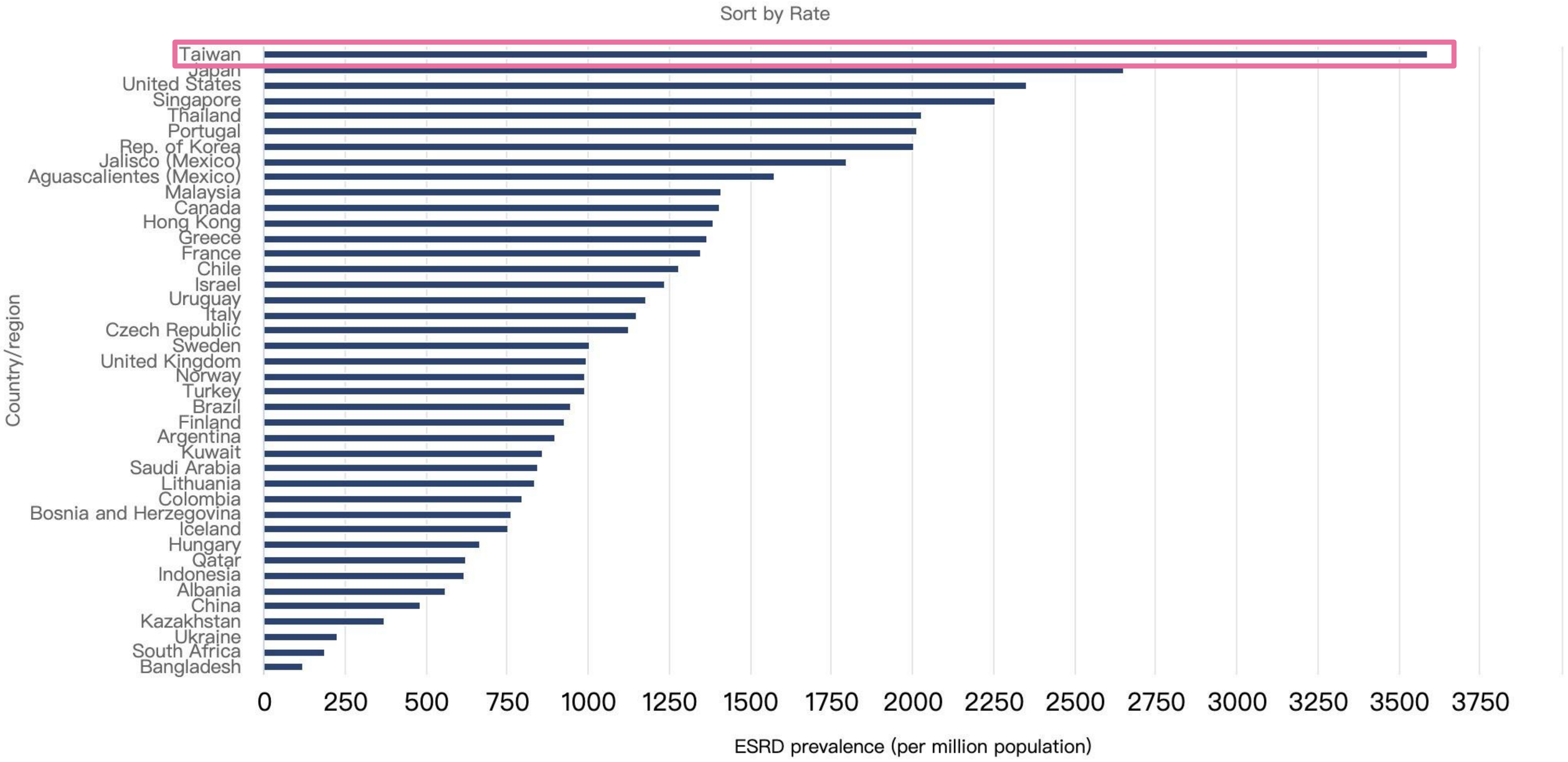
大綱

- 世界透析發生率及盛行率
- 尿毒症
- 急性腎臟損傷時，腎臟替代療法的治療時機
- 慢性腎病病人腎臟替代療法的時機及選擇
- 各種腎臟替代療法的優缺點

Introduction

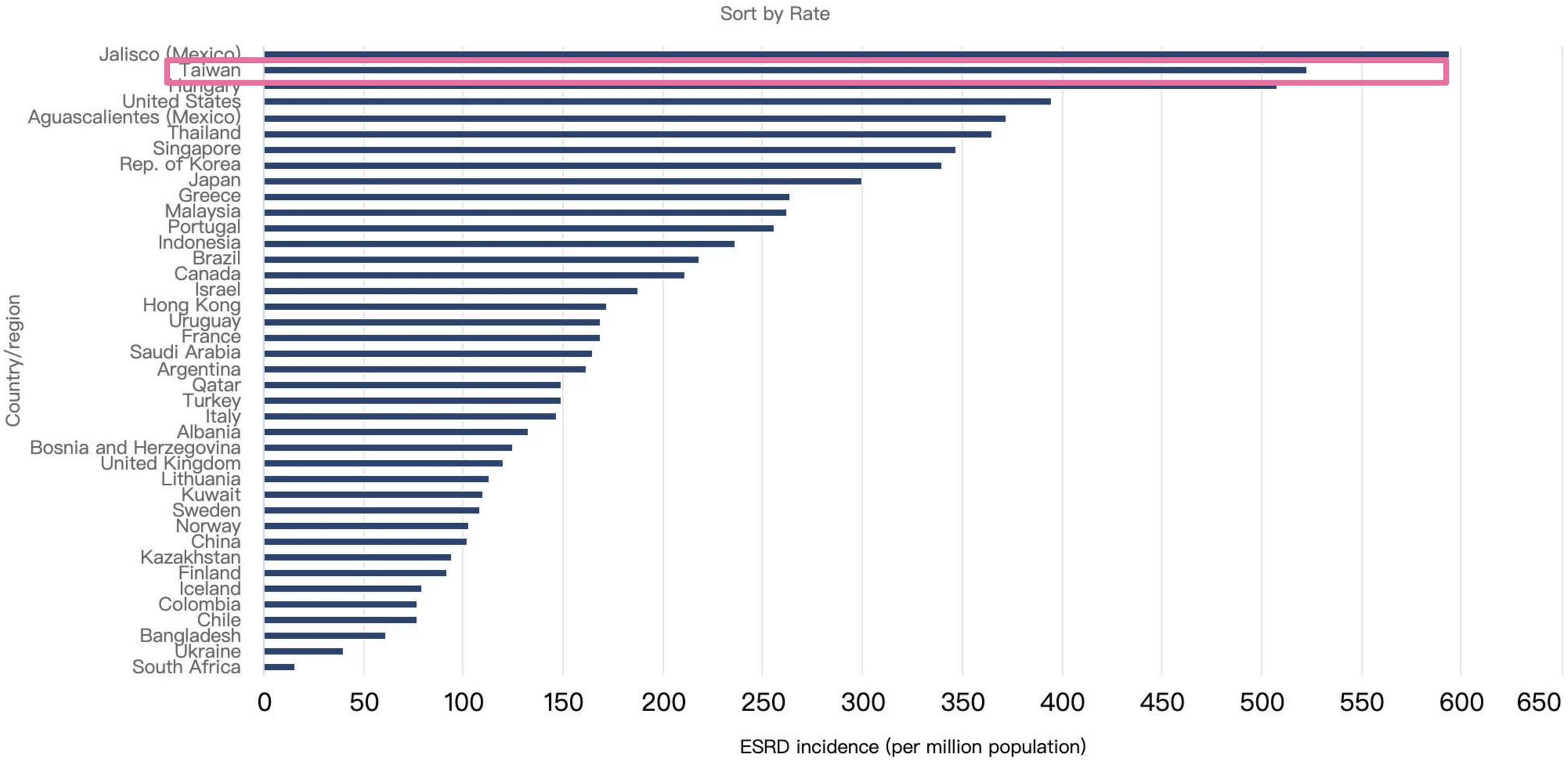
* 當腎臟功能衰退到難以負荷時的治療方法

Figure 11.9 Prevalence of treated ESRD, by country or region, 2018



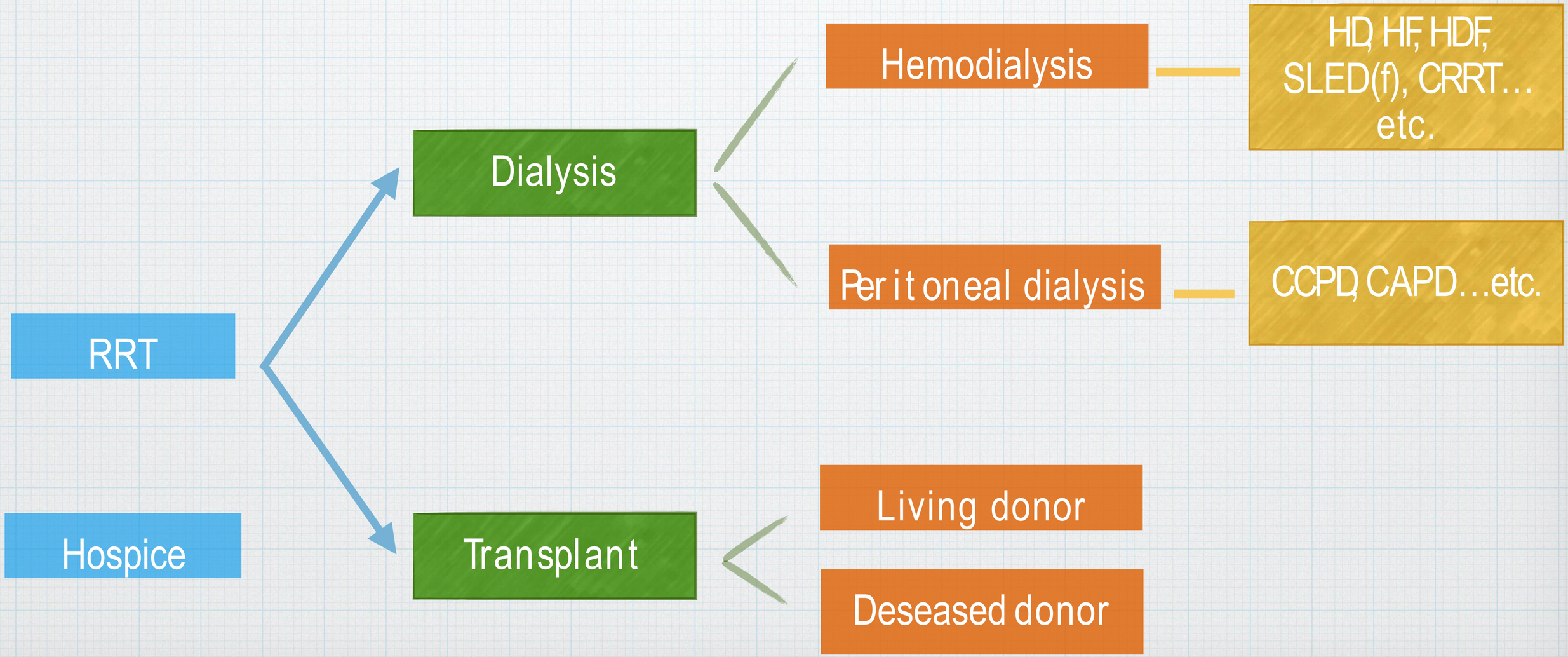
Data Source: 2020 United States Renal Data System Annual Data Report

Figure 11.2 Incidence of treated ESRD, by country or region, 2018



Data Source: 2020 United States Renal Data System Annual Data Report

Renal replacement therapy(RRT)



When?

Indications

- A: Refractory metabolic acidosis
- E: Refractory electrolyte imbalance
- I: Intoxication
  - ex: methanol, ethylene glycol, salicylate,lithium, barbiturate..etc.

    O: Fluid overload
  - U: Uremia

Uremia

- Neural and muscular
  - Fatigue, Peripheral neuropathy, Decreased mental acuity, Seizures, Anorexia and nausea, Decreased sense of smell and taste, Cramps, Restless legs, Sleep disturbances, Coma, Reduced muscle membrane potential

Uremia

- Endocrine and metabolic
  - Amenorrhea and sexual dysfunction, Reduced body temperature, Altered amino acid levels, Bone disease due to phosphate retention, hyperparathyroidism, and vitamin D deficiency, Reduced resting energy expenditure, Insulin resistance, Increased protein–muscle catabolism

Uremia

- Serositis (including pericarditis)
- Itching Hiccups
- Anemia due to erythropoietin deficiency and shortened red-cell survival
- Granulocyte and lymphocyte dysfunction
- Platelet dysfunction
-

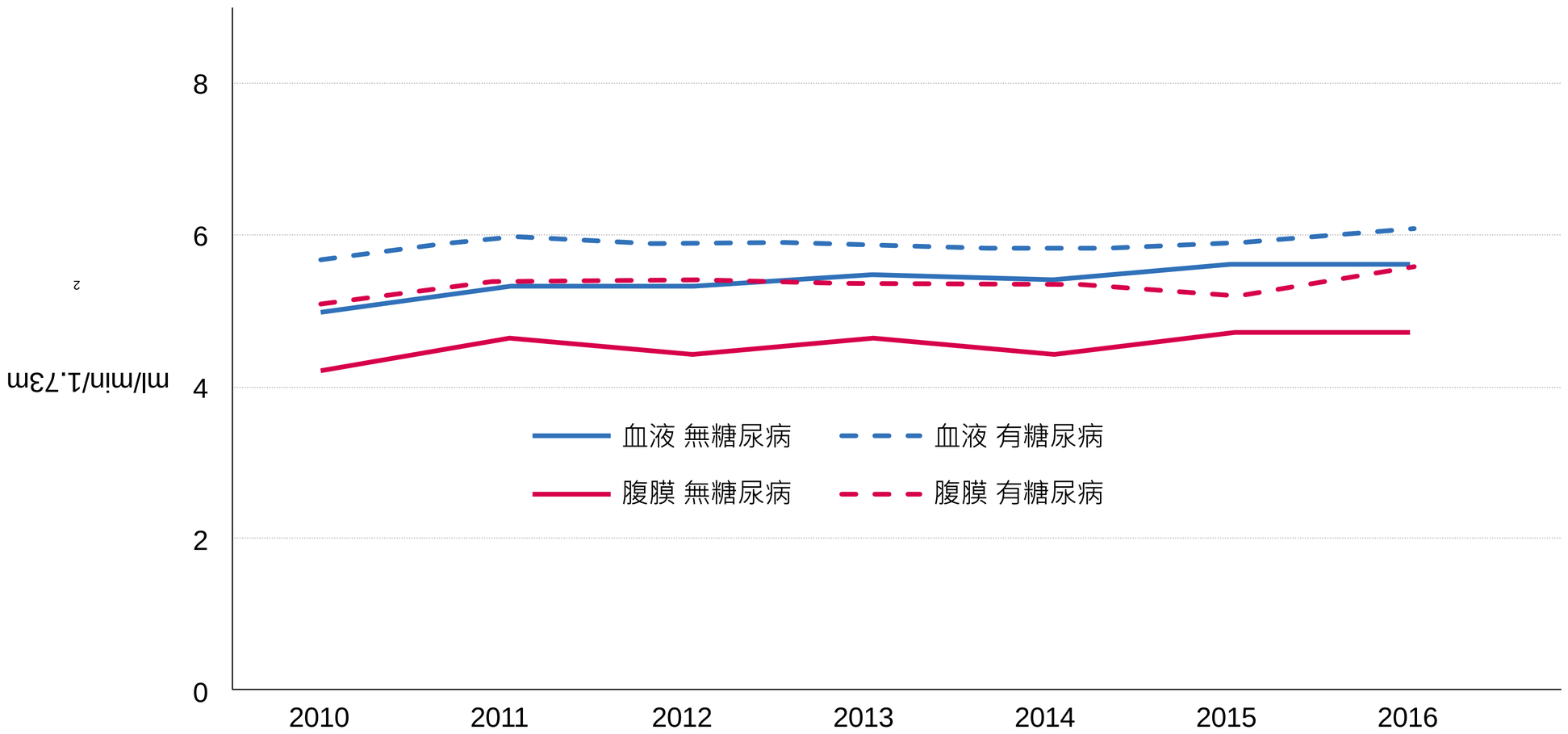


圖 10 新發透析患者eGFR 值趨勢(依透析模式別、糖尿病別)

Earlier?

Acute kidney injury

- In ICU with Acute kidney injury(AKI)
  - > KDIGO stage 2
  - Creatinine doubling
  - Creatinine increase 0.3 mg/dl (when baseline >4)
  - Urine output < 6mL/ Kg/ 12 hrs

N Engl J Med 2020;383:240-51.

Standard

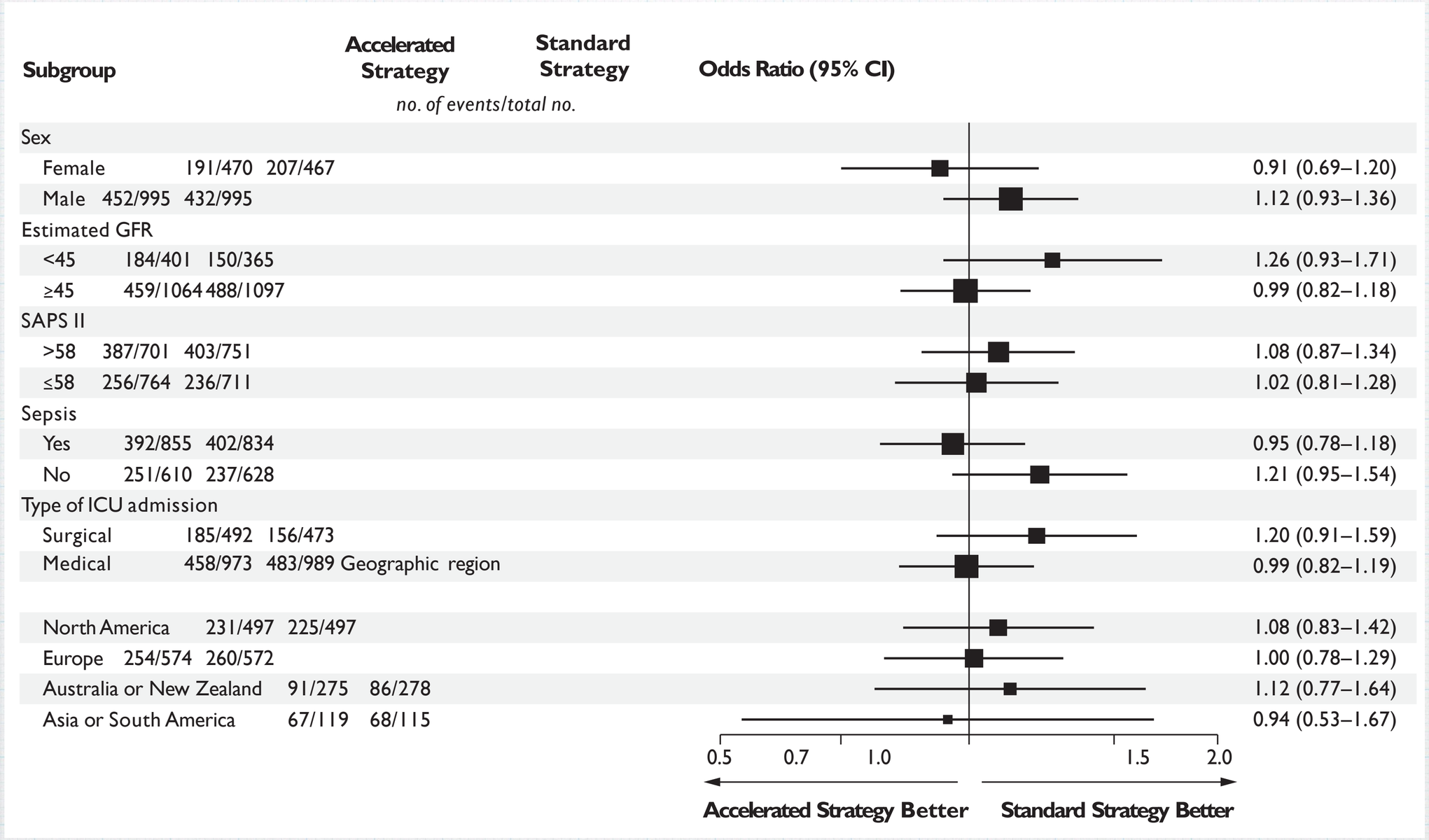
- K< 6.0 mmol/ L
- pH < 7.20 or serum bicarbonate level <12 mmol/ L
- PaO2/FiO2 < 200
- Clinical perception of volume overload
- Persistent acute kidney injury for at least 72 hours

N Engl J Med 2020;383:240-51.

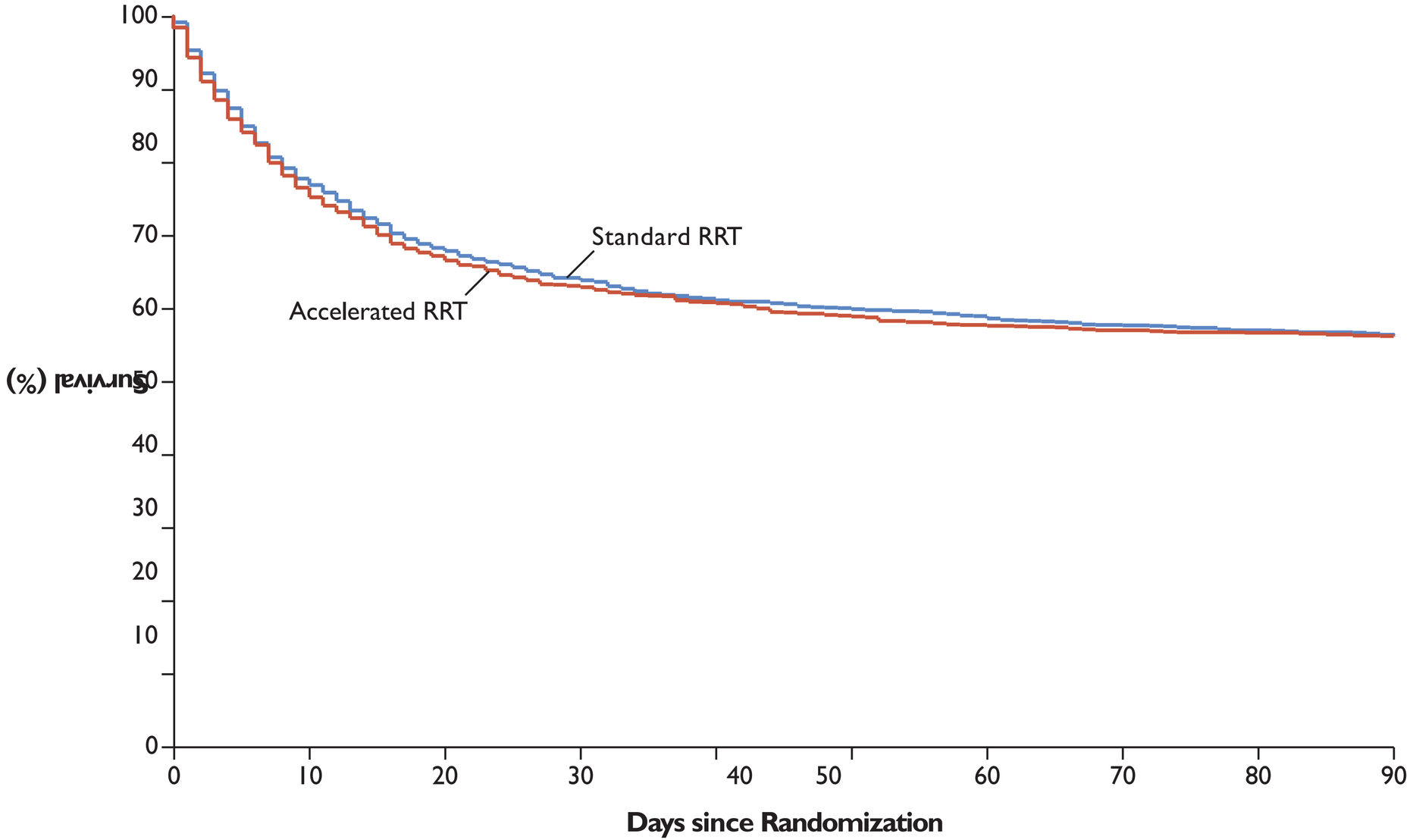
Accelerated RRT initiation

- A dialysis catheter will be placed
- RRT initiated <12 hours

N Engl J Med 2020;383:240-51.



N Engl J Med 2020;383:240-51.

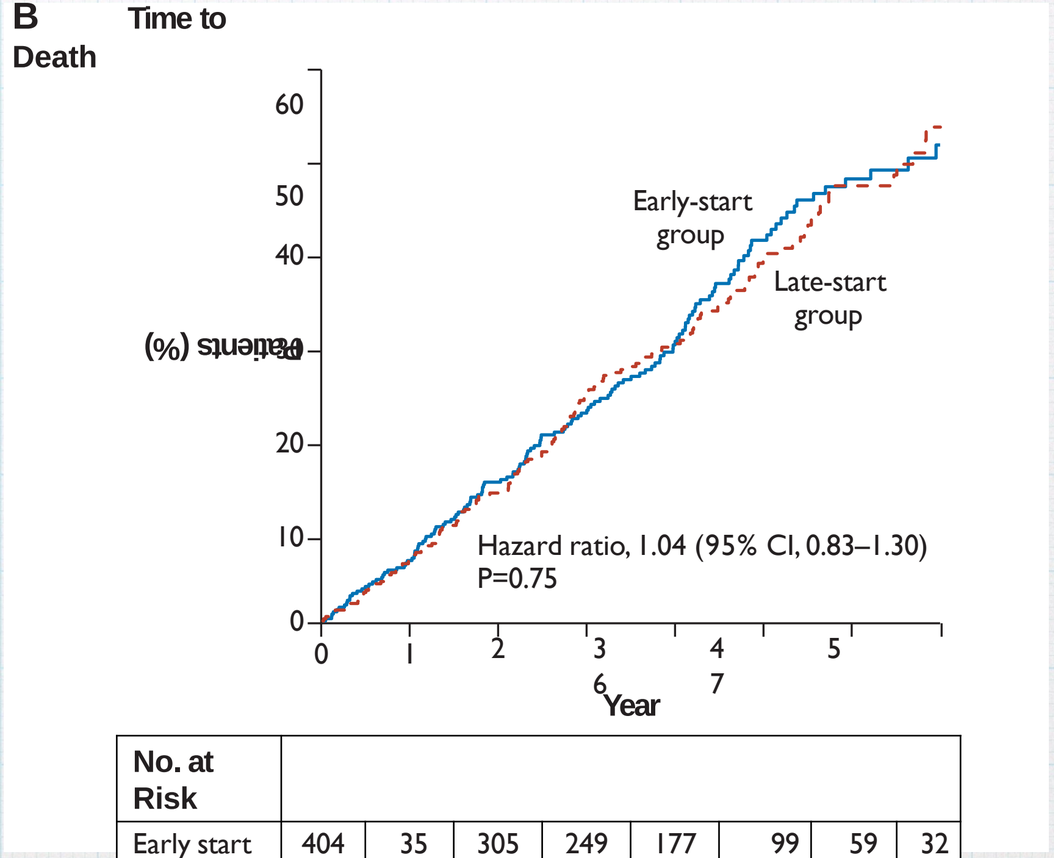


No. at Risk										
Standard RRT	1462	1138	999	939	897	878	862	844	833	823
Accelerated RRT	1465	1122	985	925	892	865	846	835	830	823

N Engl J Med 2020;383:240-51.

In chronic patient ?

* Didn’t have difference



No. at Risk								
Early start	404	358	305	249	177	99	59	32
Late start	424	385	333	254	187	115	60	32

N Engl J Med 2010;363:60919.

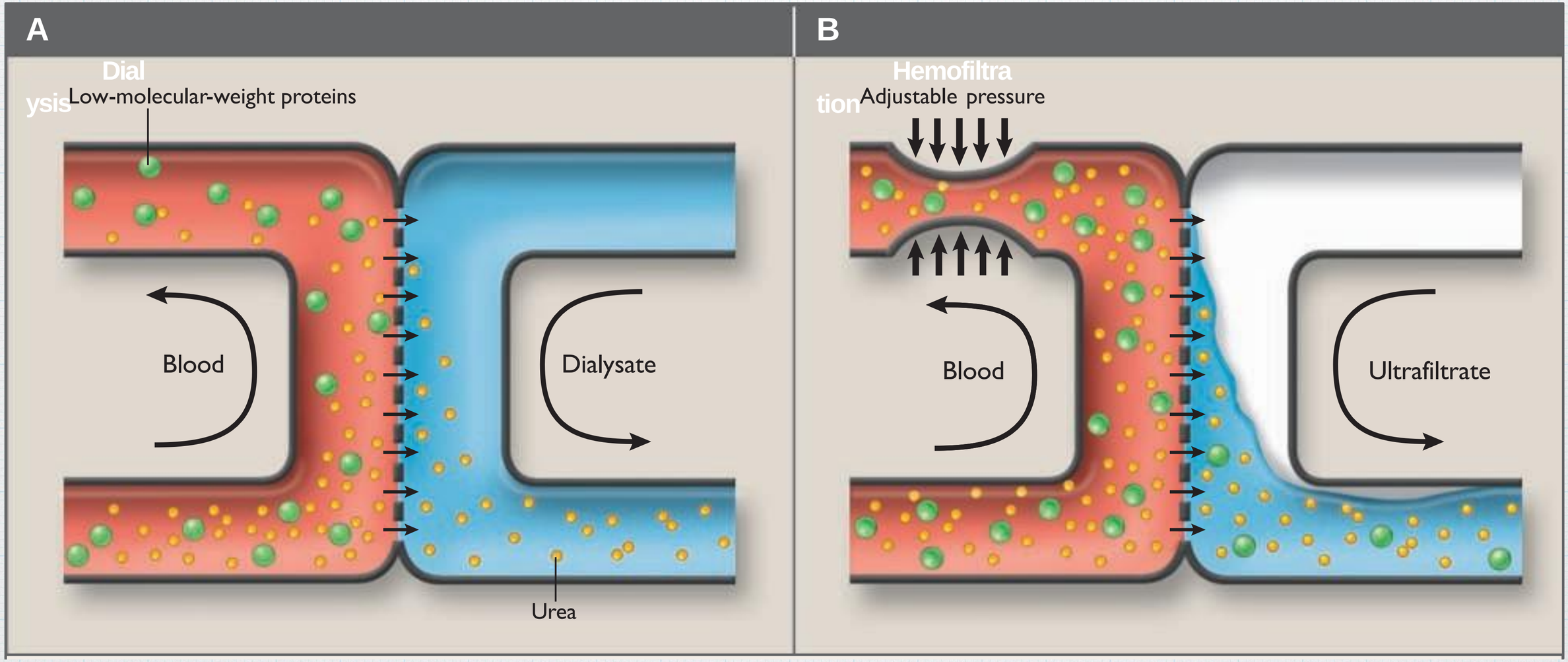
提早透析沒好處

Hemodialysis

Contraindication

* Lack of vascular access

* Diffusion
* Convection (Ultrafiltration)

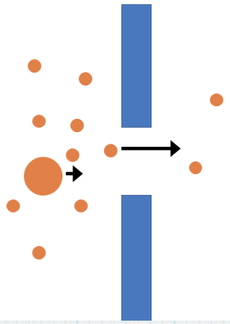


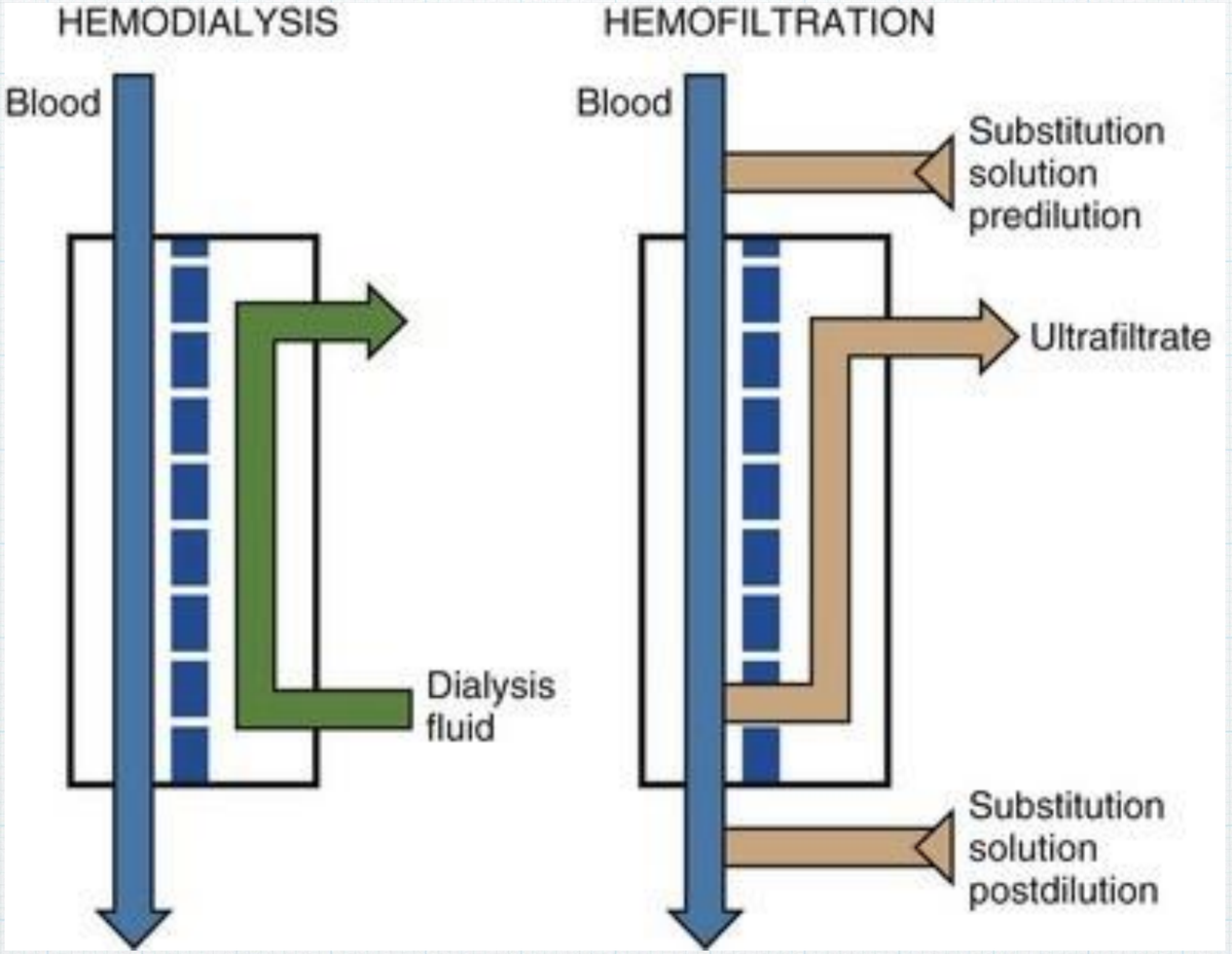
N Engl J Med 2007;357:1316-25.

HD

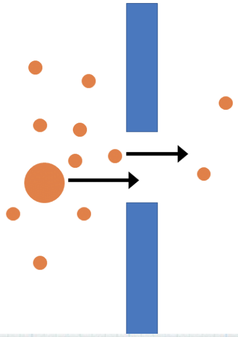
HF

Diffusion



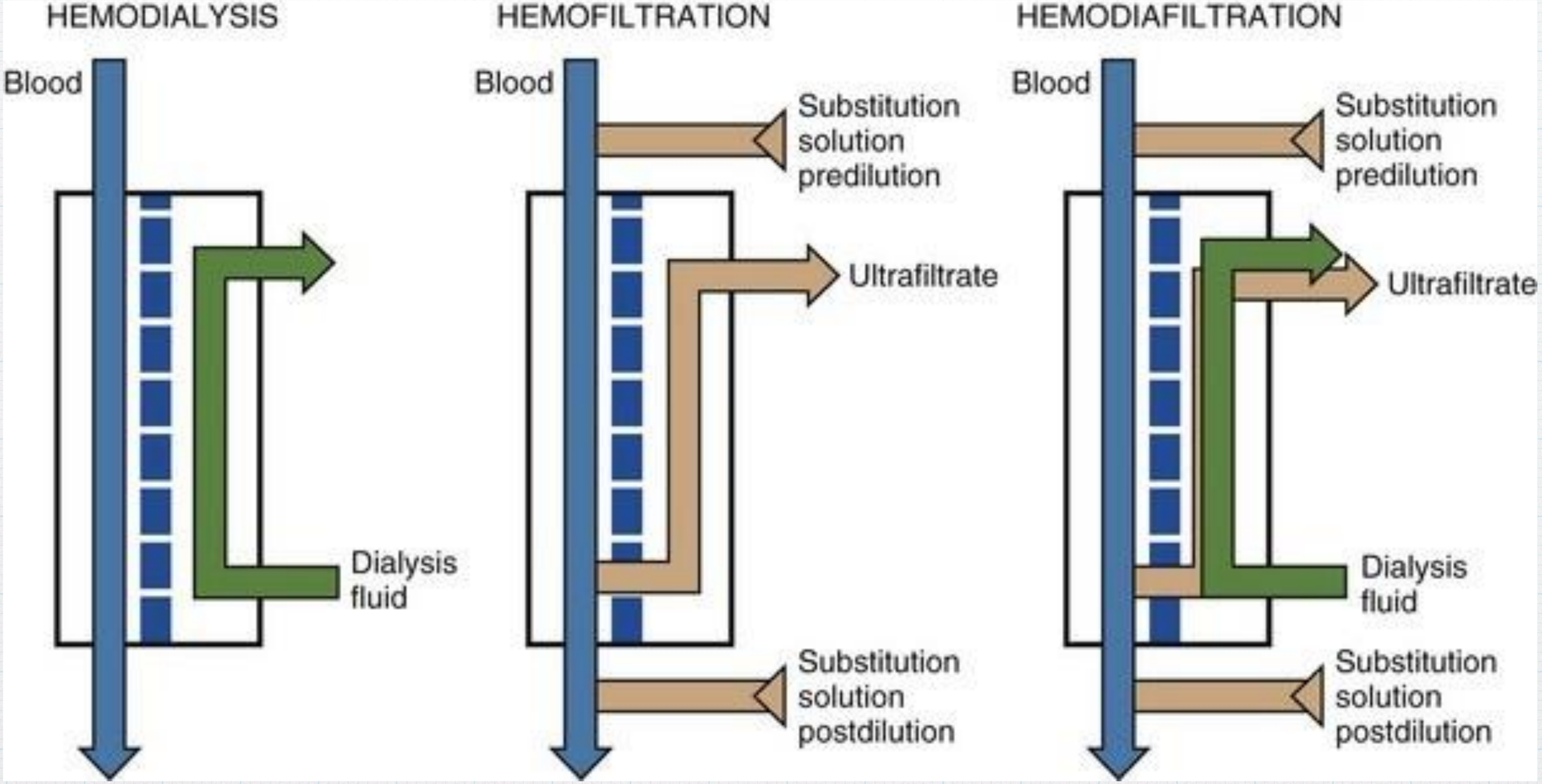


Convection



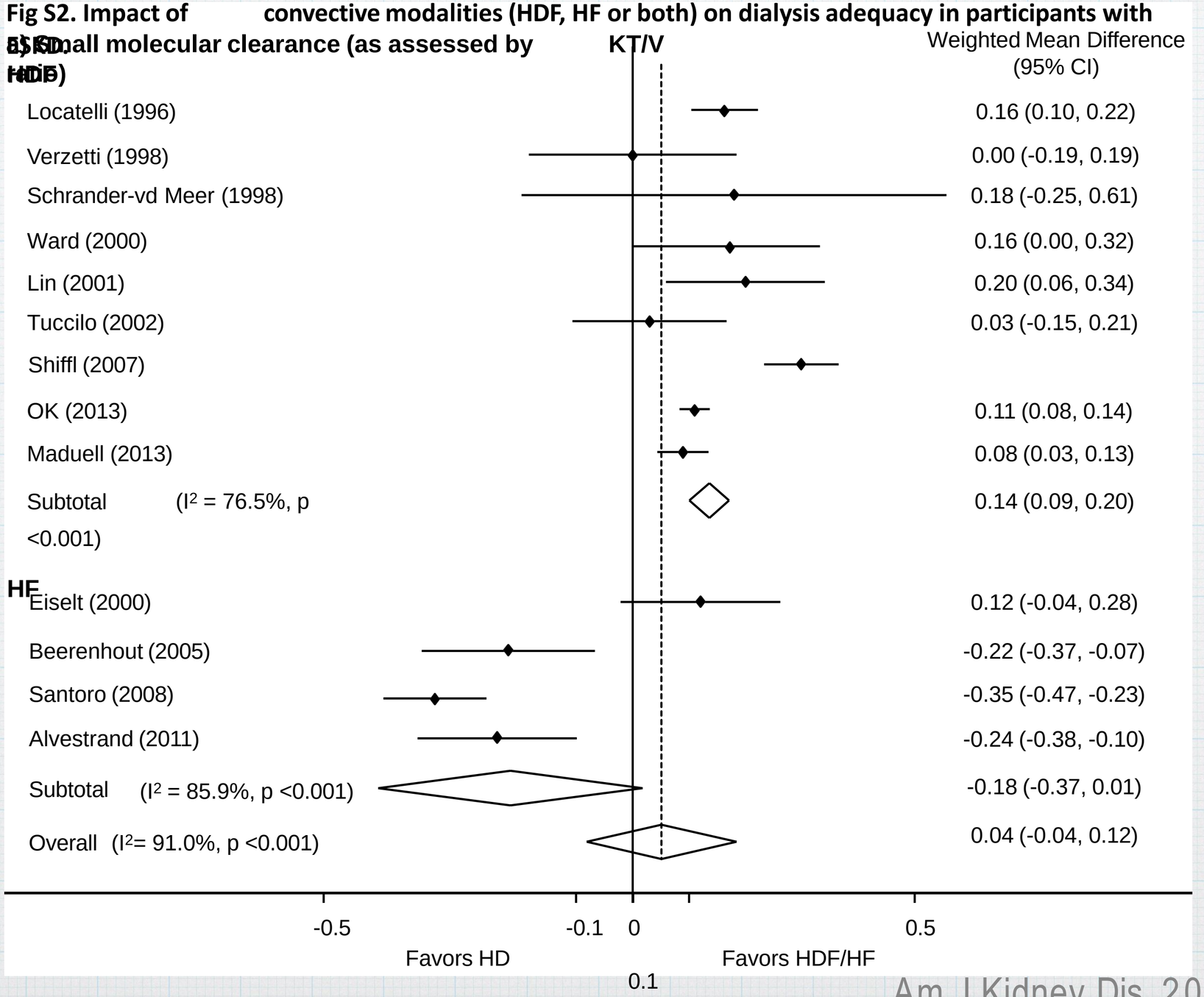
In Critical Care Nephrology, 2/E. Phila., WB Saunders, 2008. (Fig . 215-001).

	HD	HF
Fluid	Dialysate	Replacement fluid
分子量	小	中
Clearance	Diffusive>>connective	Convective

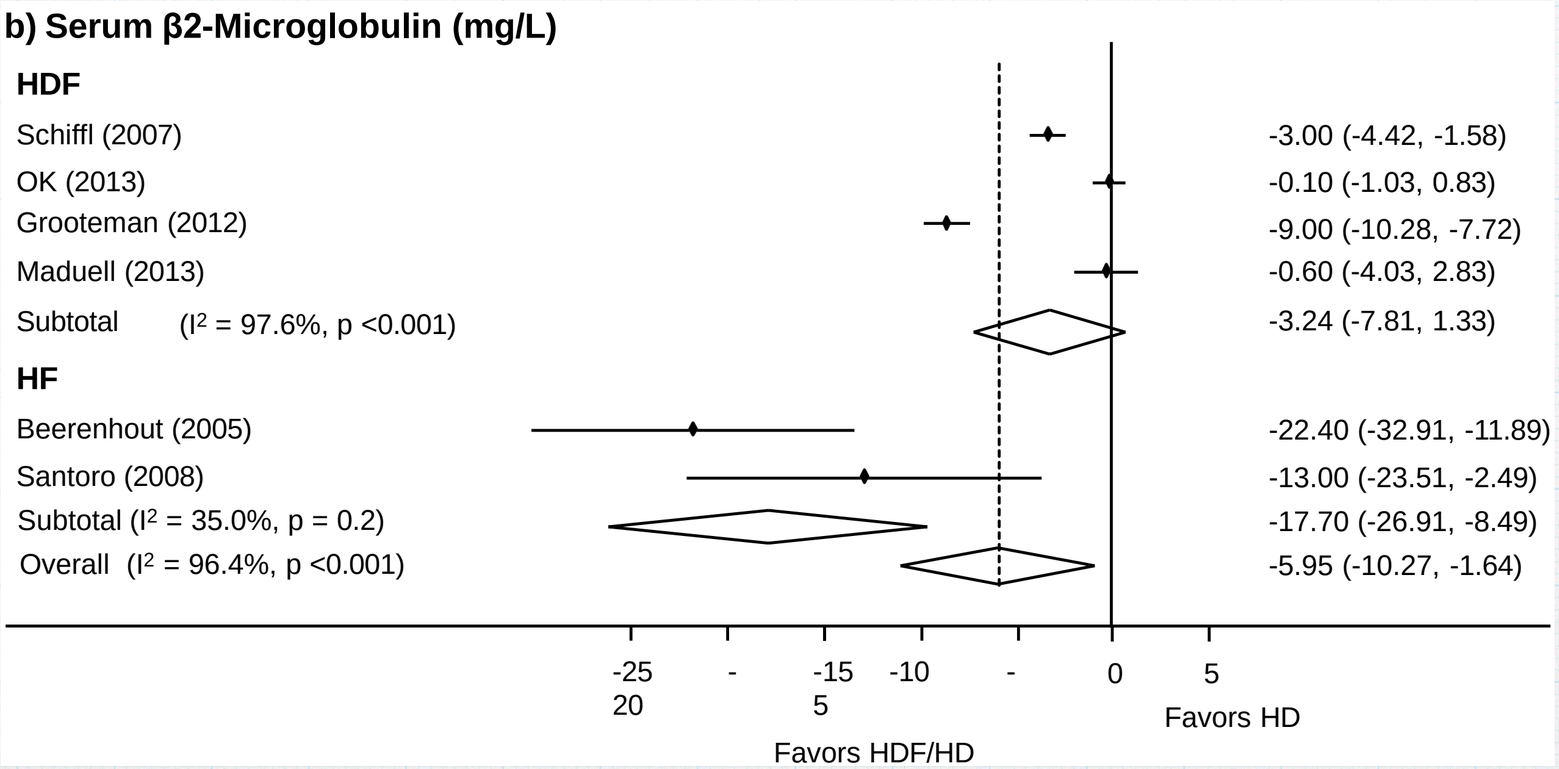


In Critical Care Nephrology, 2/E. Phila., WB Saunders, 2008. (Fig. 215-001).

Fig S2. Impact of convective modalities (HDF, HF or both) on dialysis adequacy in participants with ESRD. a) Small molecular clearance (as assessed by KT/V HDF)



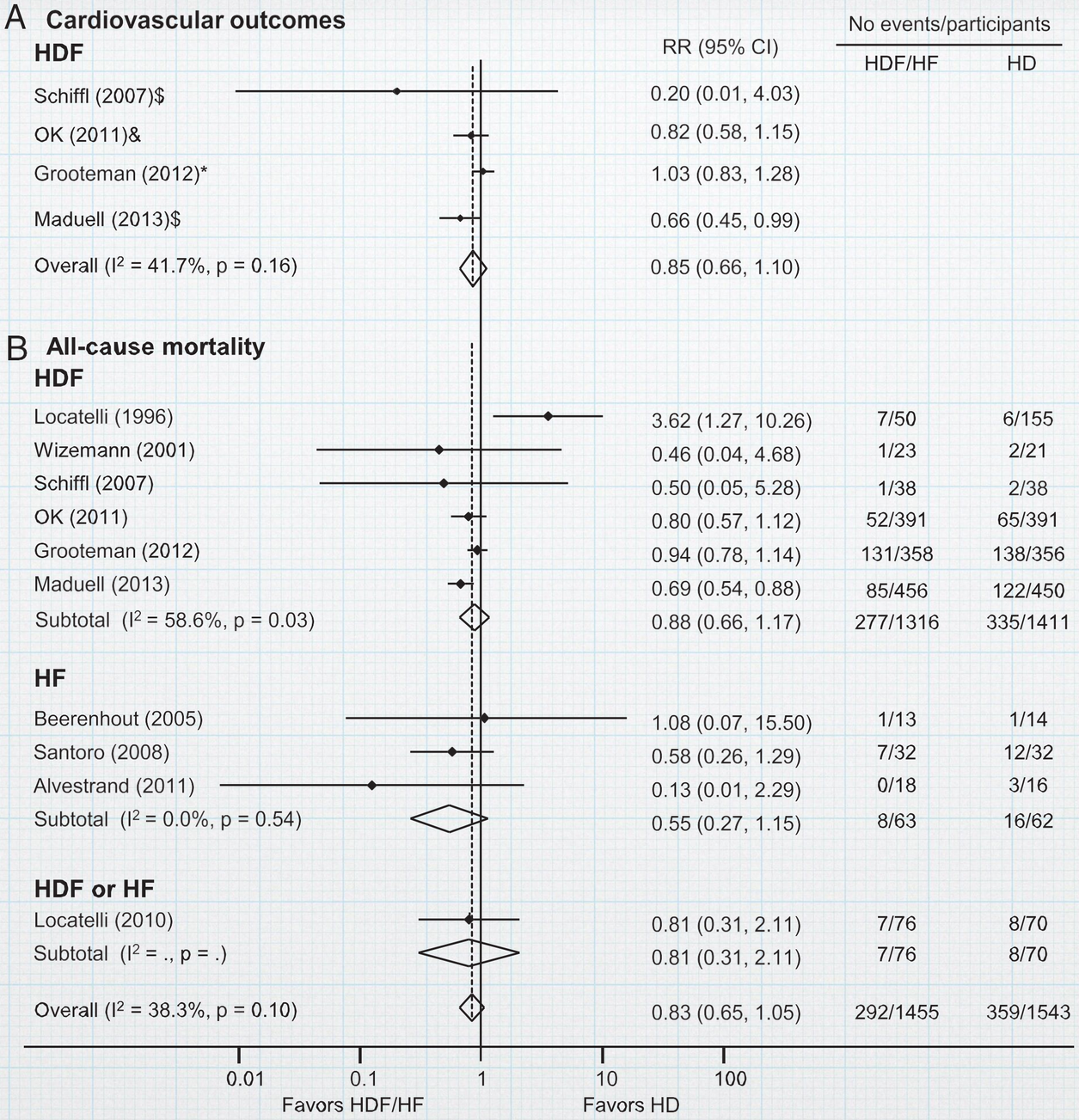
Am J Kidney Dis. 2014 Jun;63(6):968-78



Am J Kidney Dis. 2014 Jun;63(6):968-78

Benefit ?

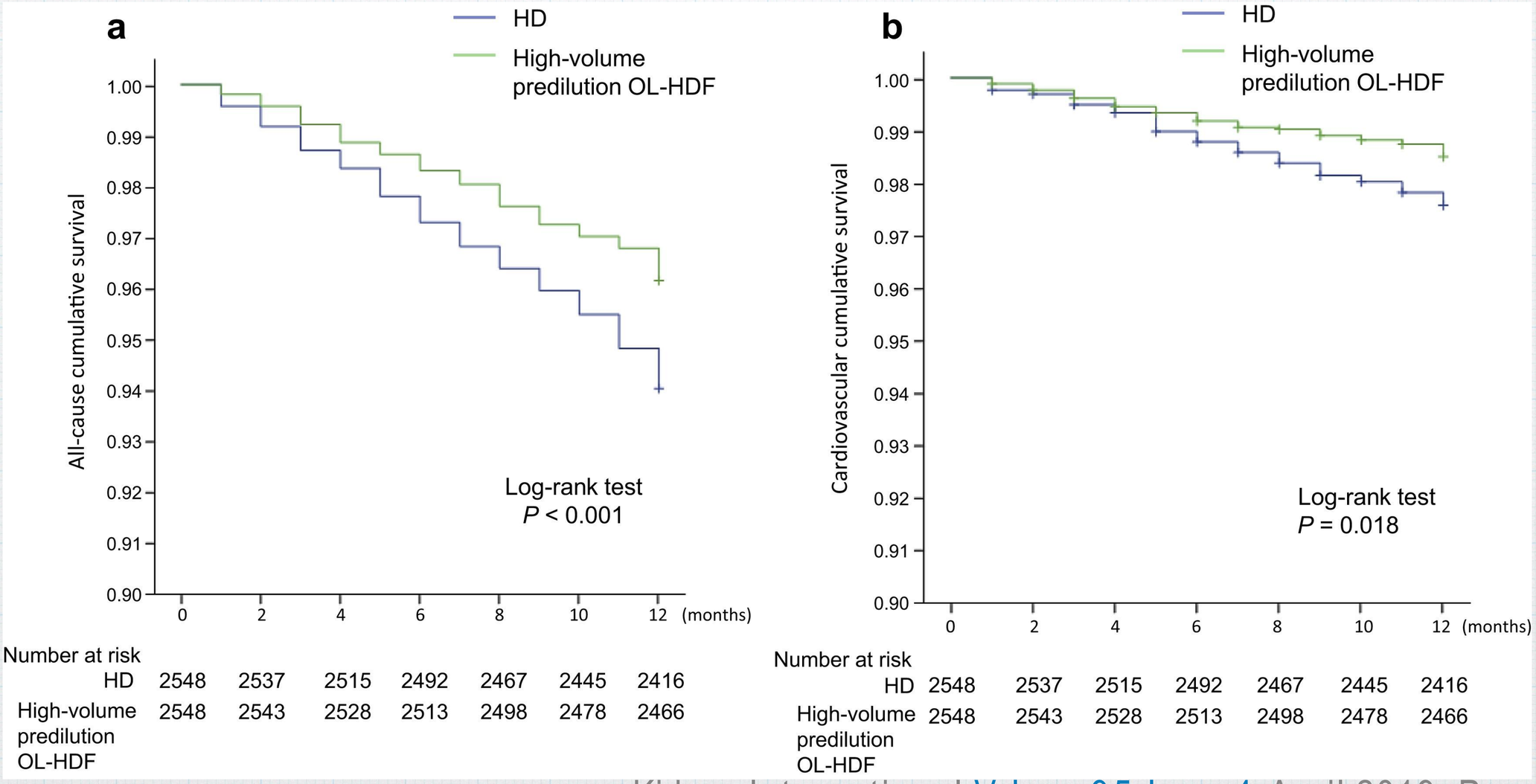
* Middle-molecular-weight molecules and phosphate
* Hemodynamic stability Inflammation
* Erythropoiesis-stimulating agent resistance
* Quality of life
*



Am J Kidney Dis. 2014 Jun;63(6):968-78

But...??

High volume HDF



Kidney International Volume 95, Issue 4, April 2019, Pages 929-938

* Japanese Society for Dialysis Therapy Renal Data Registry database from December 31, 2012 to December 31, 2013.

Kidney International Volume 95, Issue 4, April 2019, Pages 929-938

Continuous renal replacement therapy (CRRT)

* Hemodynamic
* Gradual correction of fluid, electrolyte

- Complications:
  - Electrolyte/Acid-Base Pi,
    - ↓Ca, Mg
    - Metabolic alkalosis
  - Drugs dosing
  - Clot
  - Catheter-related
  - infection Hypothermia
  - Thrombocytopenia

Sustained low efficiency daily dialysis (SLEDD)

- Slow flow
- Longer: 6-8hrs
- Less cost (vs CRRT)

Heparin

Table 63.8 Guidelines for Anticoagulation in Hemodialysis Patients at High Risk for Serious Bleeding

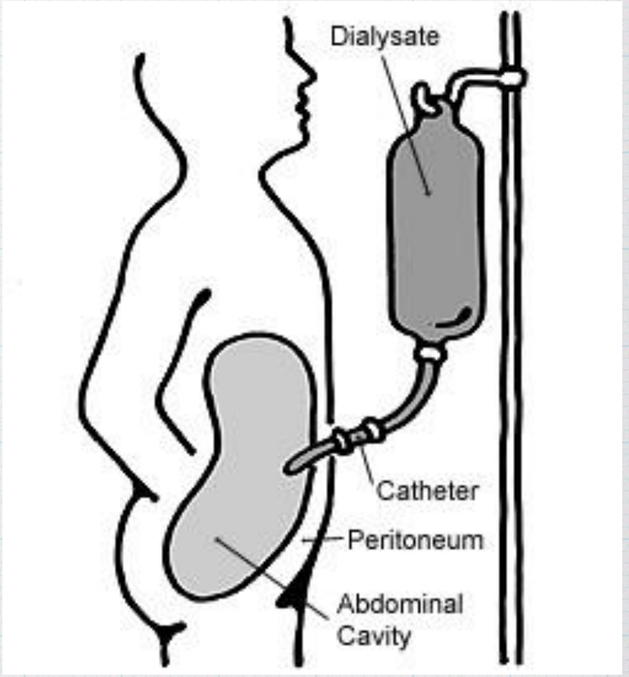
Anticoagulation for Hemodialysis	Clinical Condition
No anticoagulation or regional anticoagulation	Actively bleeding Significant risk for bleeding Major thrombostatic defect Major surgery within 7 days Intracranial surgery within 14 days Biopsy of visceral organ within 72 hours Pericarditis Major surgery beyond 7 days
Low-dose heparin	Biopsy of visceral organ beyond 72 hours Minor surgery 8 hours prior Minor surgery within 72 hours Major surgery 8 hours prior
Low-dose heparin or no anticoagulation	

Table 63.3 Characteristics of Ideal Hemodialysis Vascular Access Compared With Commonly Available Types

Desired Characteristic	Autogenous AV Fistula	AV Graft	Central Venous Catheter
High primary patency rate Instant	★	★★	★★★
usability	★	★★	★★★
Long survival	★★★	★★	★
Low thrombosis rate Low infection	★★★	★★	★
rate	★★★	★★	★
High blood flow rate on hemodialysis	★★★	★★★	★
Patient comfort	★	★	★★★
Patient bathing/hygiene Minimize	★★★	★★★	★
needles Minimal cosmetic affect	★	★	★★★
	★	★★	★★

AV, Arteriovenous.

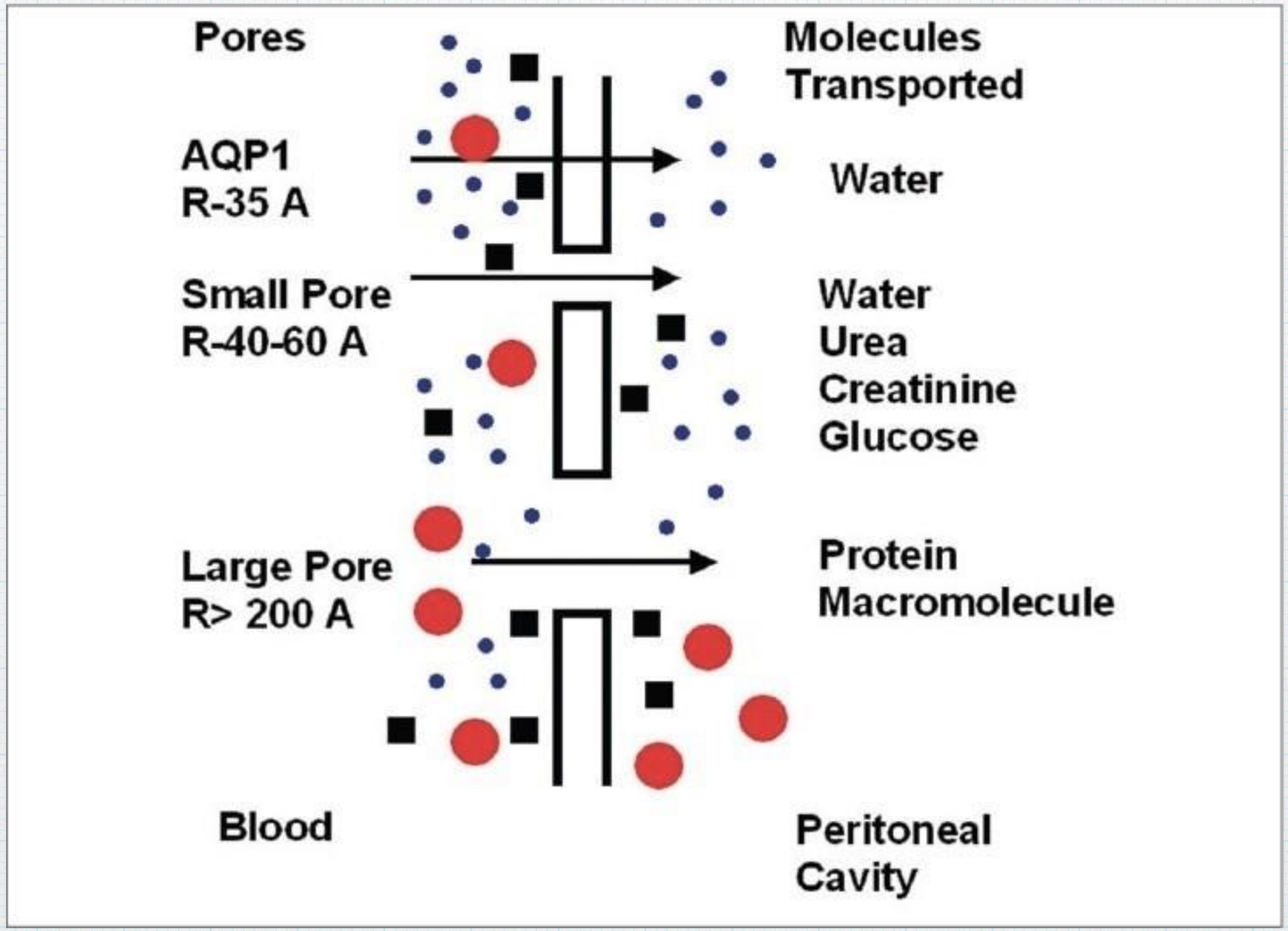
Peritoneal dialysis



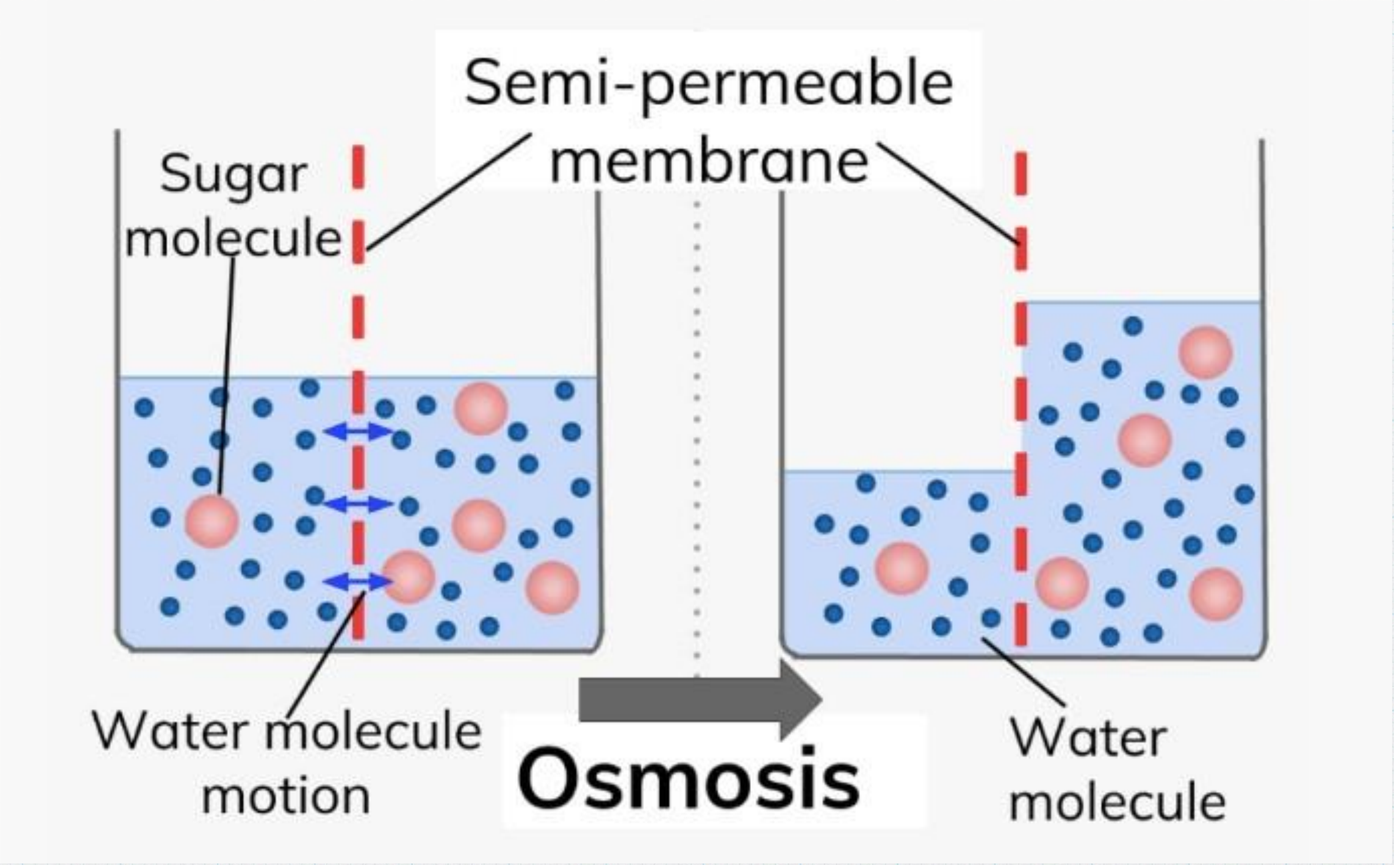
Contraindications

- No functional peritoneal membrane
- Active abdominal wall infection
- Several intestinal disease
- AKI in pregnancy Can't operate
-

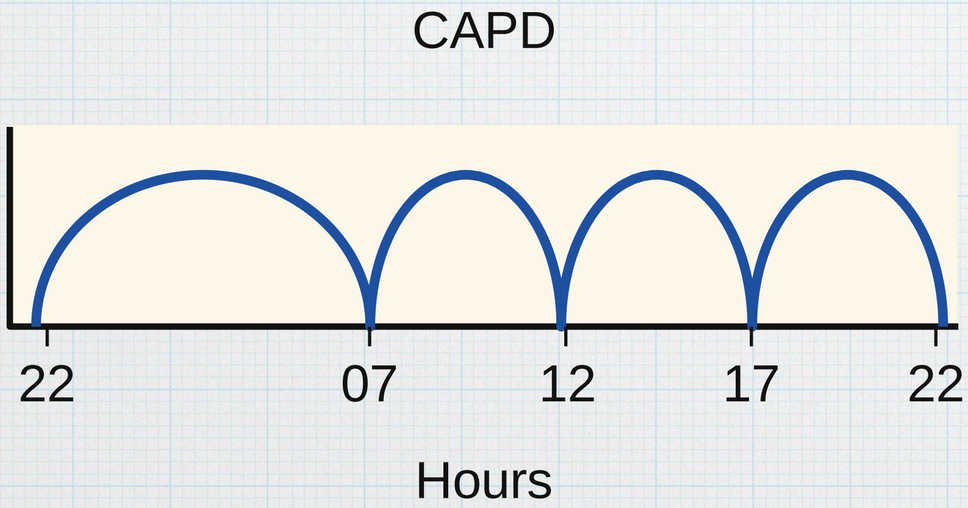
Peritoneal transport

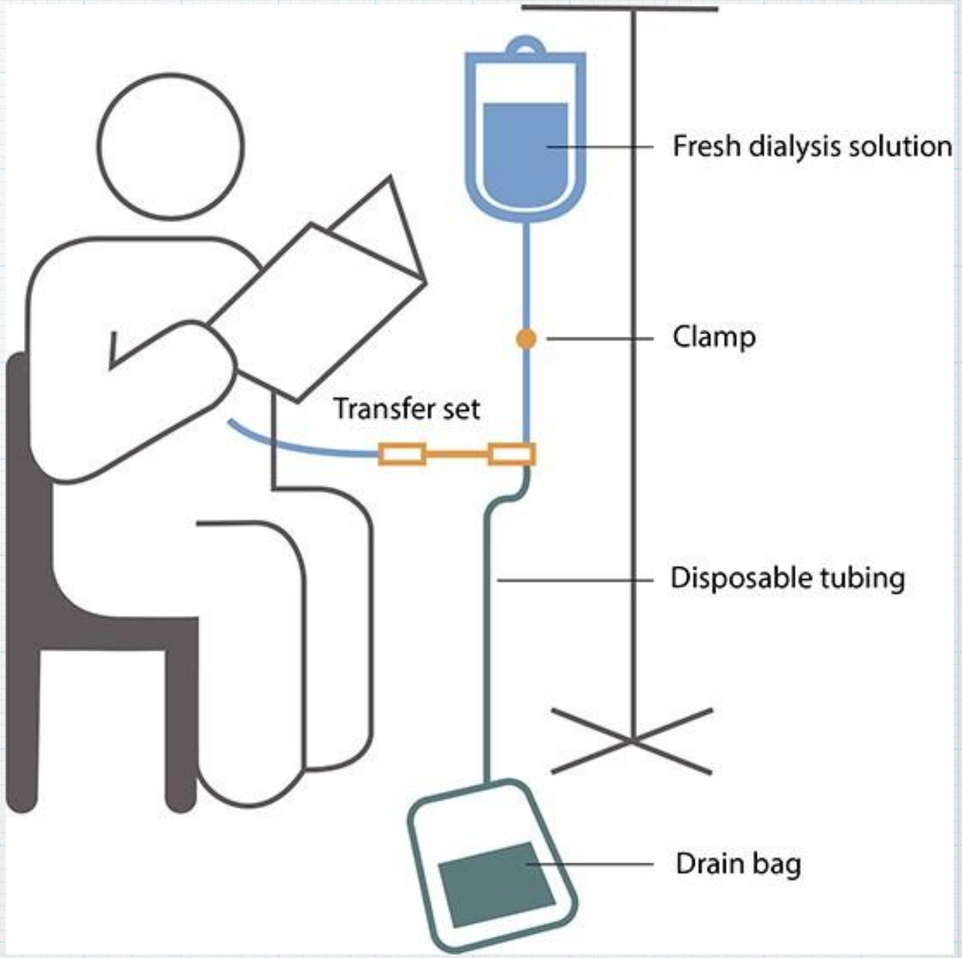


* Diffusion
* Osmosis



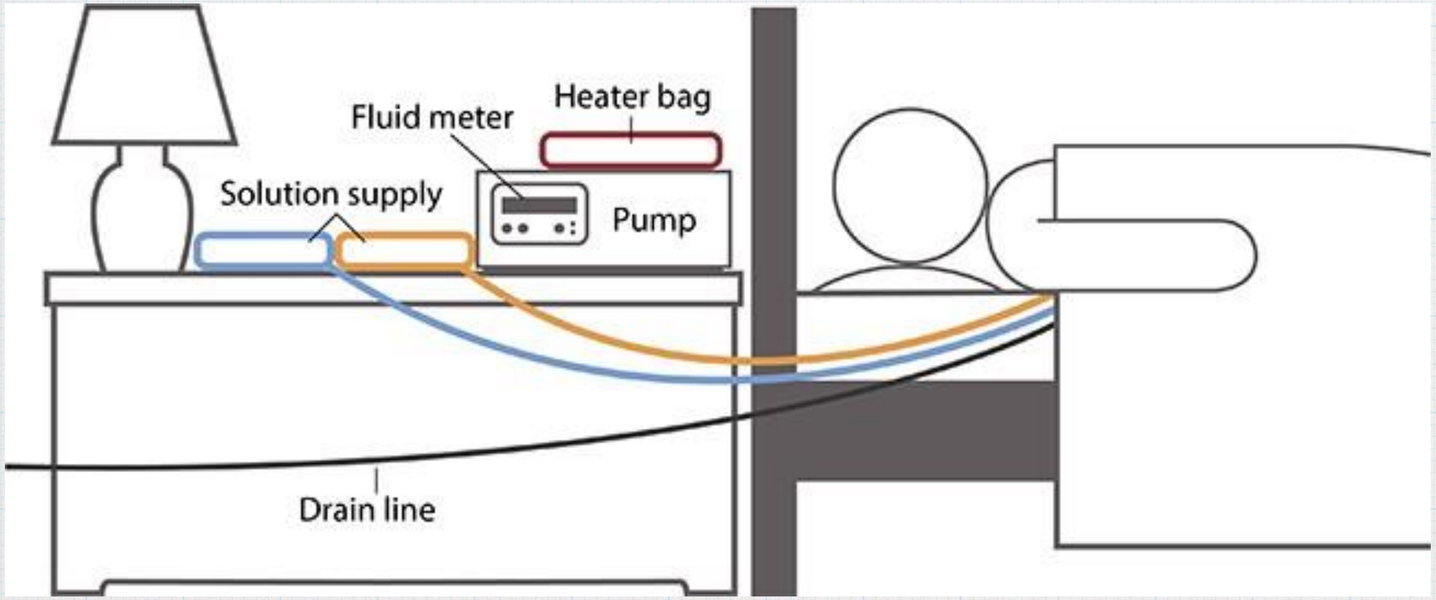
Continuous ambulatory peritoneal dialysis



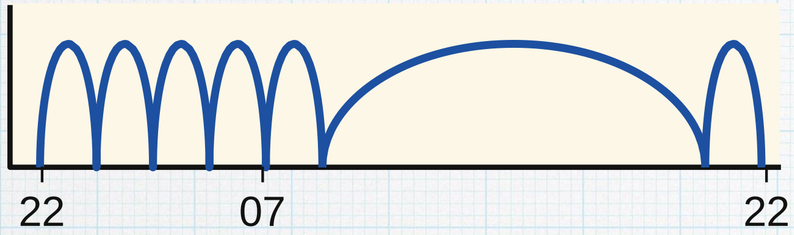


Brenner and Rector's the Kidney 9th Ed

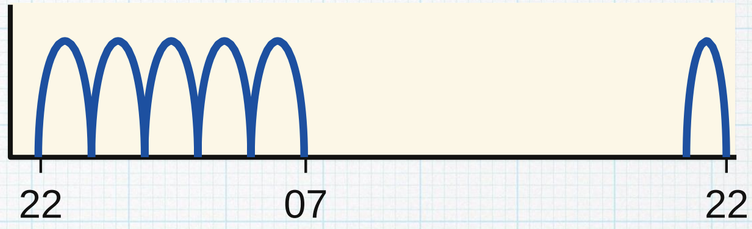
Automated Peritoneal Dialysis



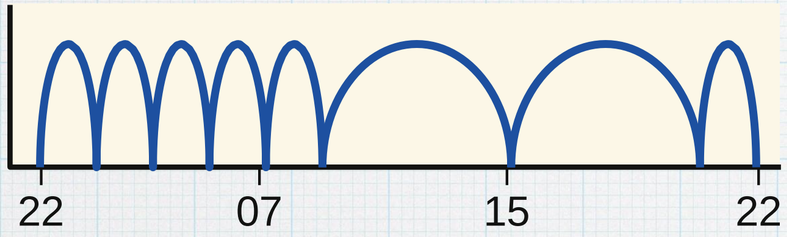
APD WITH LONG DAY DWELL (CCPD)



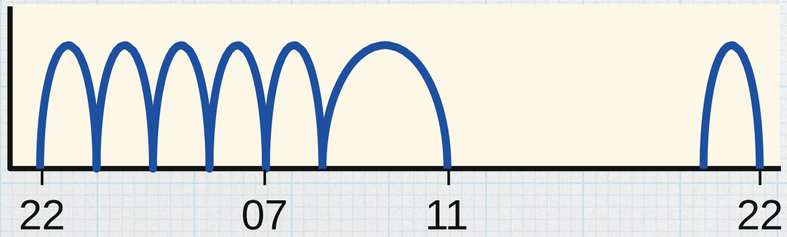
“DAY DRY” APD



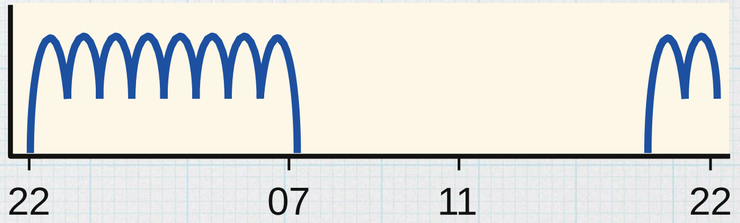
APD WITH TWO DAY DWELLS



APD WITH SHORT DAY DWELL



TIDAL APD WITH NO DAY DWELL (50% TIDAL)



* 請勿用一般血糖機量測

Table 64.2 Components of Different Peritoneal Dialysis Solutions Available Commercially

	Osmotic Agent	Buffer	pH
Conventional	Dextrose	Lactate	5.2
Low-glucose degradation product	Dextrose	Lactate or bicarbonate	7.0-7.4
	Dextrose	Lactate and bicarbonate	7.4
Icodextrin	Icodextrin	Lactate	5.2
Amino acids	Amino acids	Lactate	6.4

	HD	PD
Benefit	1. Frequent monitor 2. Less responsibility 3. Socialization 4. Suitable for multiple comorbidities	1. Less cost 2. Autonomy 3. High quality of life 4. Residual renal function 5. Hemodynamic 6. Less pain

Disadvantages

* Fluid
* Peritoneal function
* Nutrition loss

Transplantation

Contraindications

- Life-threatening infections,
- Cancer
- Unstable cardiovascular disease
- Nonadherence

受腎者

* 在10~65歲之間的末期尿毒症患者
* 除了原發性腎病外無其他嚴重性疾病
    * 如：癌症，活動性感染，先天性泌尿系統異常
* 能完全瞭解移植的成功率，危險性，合併症等，並自願接受移植手術及承擔一切後果和手術後的自我照顧
* 膀胱及尿道正常

	Live 活腎	Deseased 屍腎
Rejection	較少	較高
How long the kidney loss	12 ~20 yrs	8 ~12 yrs
kidney health	Better	降溫保存
live expectancy	較長	較短

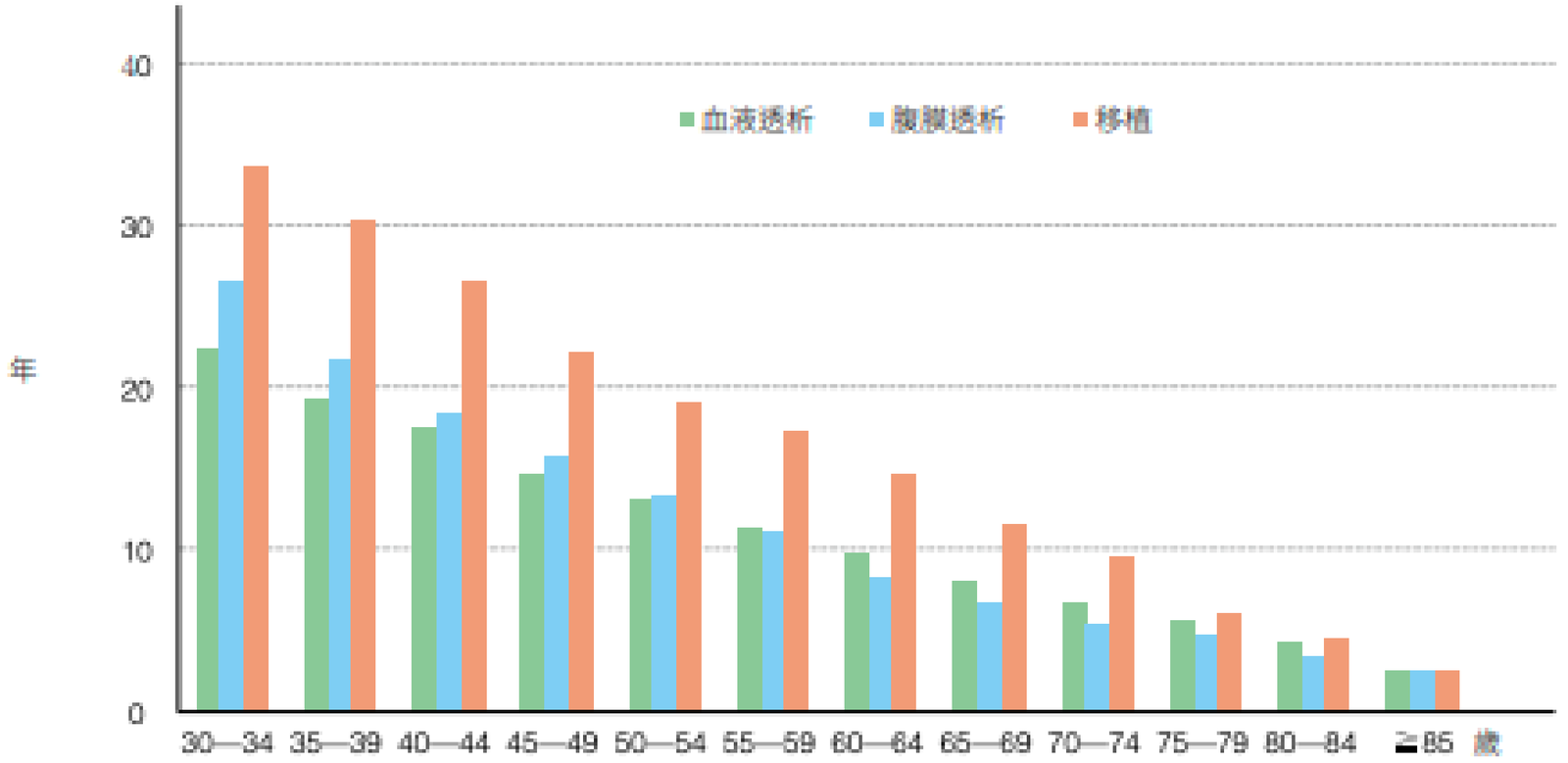
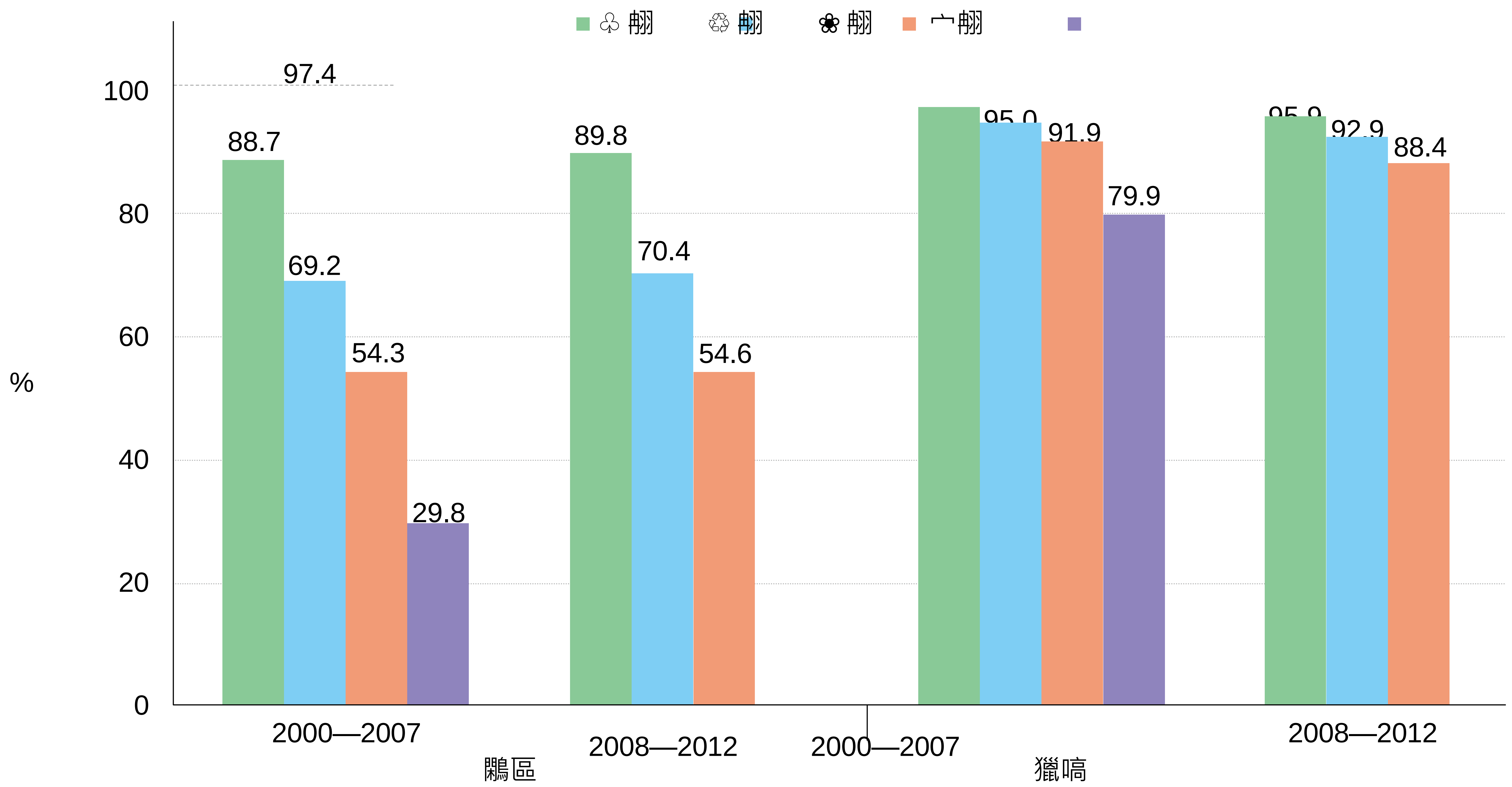


圖 68 2016年 ESRD 族群之平均餘命（依透析模式別）

資料來源：台灣健保資料庫。



吆54 鷳區莅獵嗃豞鑪♧桓♲桓❀⿻宀翤熻崞桧嫲鱇

Hospice

* 急性及慢性腎臟衰竭

優先順位

* 惡性腫瘤末期患者
* 其他重要器官衰竭及危及生命之合併症惡病質、或嚴重之營養不
* 良危及生命者
* 因老衰、其他系統性疾病，生活極度仰賴他人全時照顧，並危及生命者
* 嚴重感染性疾病合併各項危及生命之合併症。

減少症狀為主

* 不是以延長生命為主
* 可繼續透析，次數減少，以減少症狀為主

停止透析

* 可能在繼續存活 1 - 100 天
* 平均存活8 - 10天

* 安寧緩和療護並不是「遺棄病人，消極等死」而是「**尊重生命、尊重病人的自主權、有尊嚴的面對死亡**」

Thanks for your listening