HIGH VOLUME HDF – CARDIOPROTECTIVE- HOW TO ACHIEVE ?

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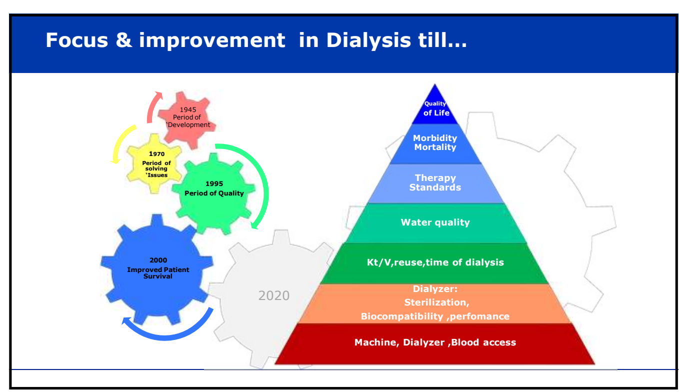
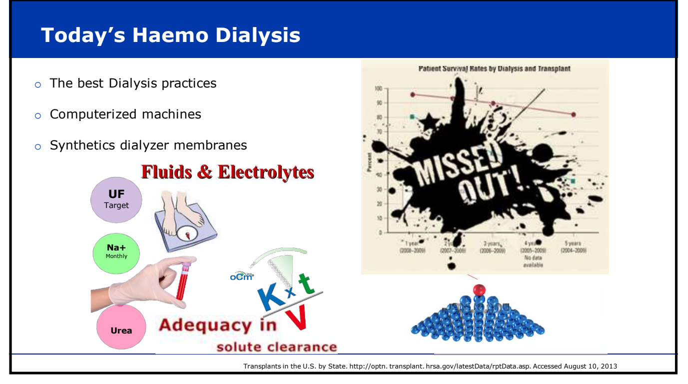
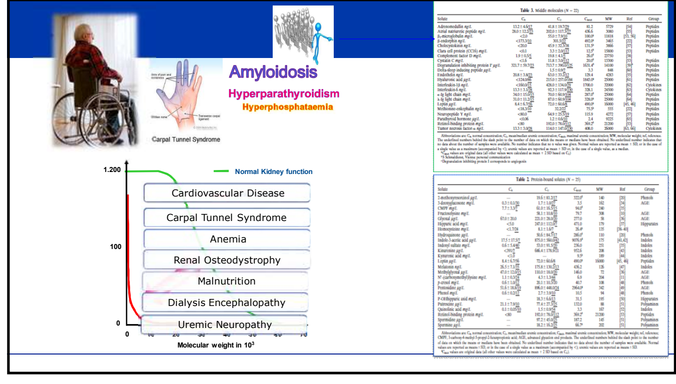
Chủ tịch hội lọc máu Thế Giới

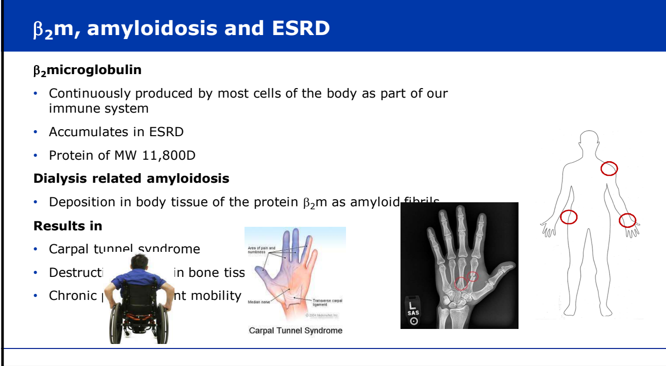




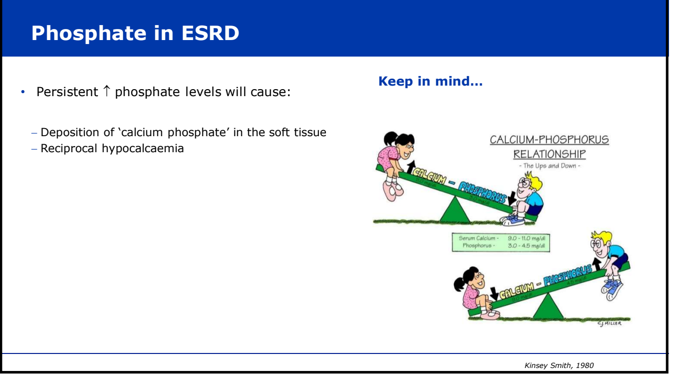
Today's Haemo Dialysis
The best Dialysis practices
Computerized machines
Synthetics dialyzer membranes
Fluids & Electrolytes
UF
Target
Na+
Monthly
Urea
Adequacy in
Kxt
V
solute clearance
Patient Survival Rates by Dialysis and Transplant
MISSED OUT!
Transplants in the U.S. by State. http://optn. transplant. hrsa.gov/latestData/rptData.asp. Accessed August 10, 2013



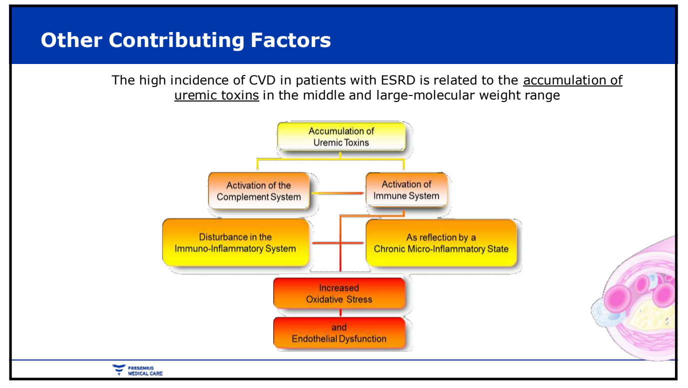
Amyloidosis
Hyperparathyroidism
Hyperphosphataemia
Carpal Tunnel Syndrome
Normal Kidney function
Cardiovascular Disease
Carpal Tunnel Syndrome
Anemia
Renal Osteodystrophy
Malnutrition
Dialysis Encephalopathy
Uremic Neuropathy
Molecular weight in 10³

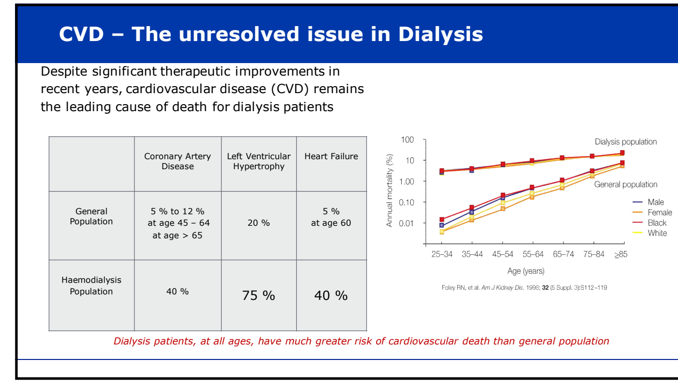


β2m, amyloidosis and ESRD
β2microglobulin
Continuously produced by most cells of the body as part of our immune system
Accumulates in ESRD
Protein of MW 11,800D
Dialysis related amyloidosis
Deposition in body tissue of the protein β2m as amyloid fibrils
Results in
Carpal tunnel syndrome
Destruct in bone tiss
Chronic nt mobility
Carpal Tunnel Syndrome

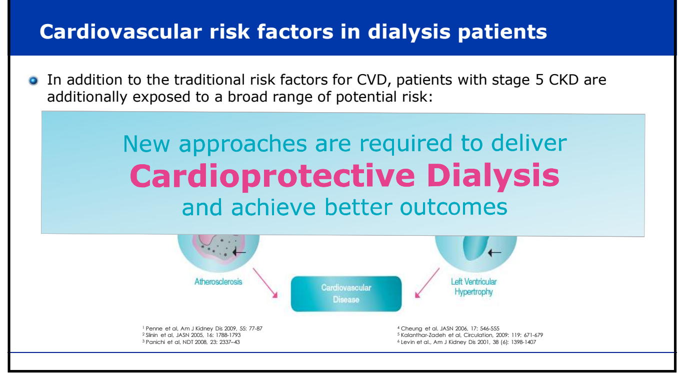


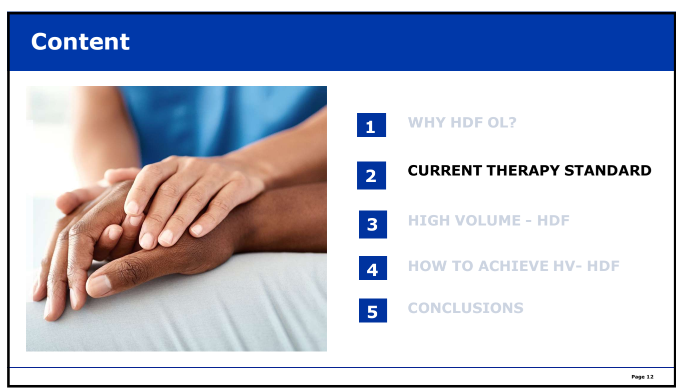
Phosphate in ESRD
Persistent ↑ phosphate levels will cause:
– Deposition of 'calcium phosphate' in the soft tissue
– Reciprocal hypocalcaemia
Keep in mind…
CALCIUM-PHOSPHORUS RELATIONSHIP
- The Ups and Down -
Serum Calcium - 9.0 - 11.0 mg/dl
Phosphorus - 3.0 - 4.5 mg/dl
Kinsey Smith, 1980

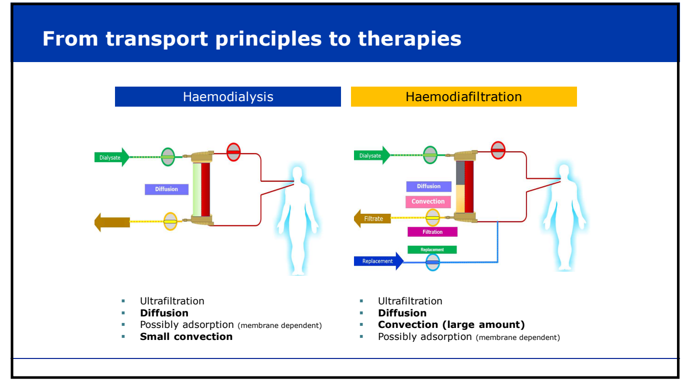


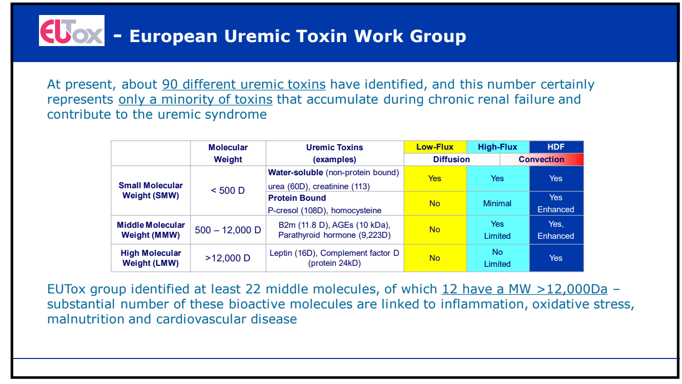


	Coronary Artery Disease	Left Ventricular Hypertrophy	Heart Failure
General Population	5 % to 12 % at age 45 – 64 at age > 65	20 %	5 % at age 60
Haemodialysis Population	40 %	75 %	40 %

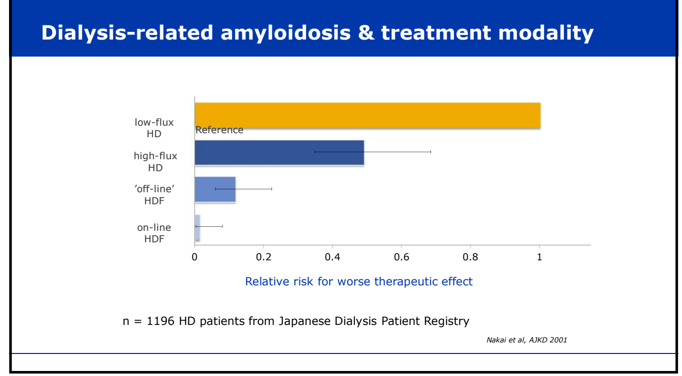


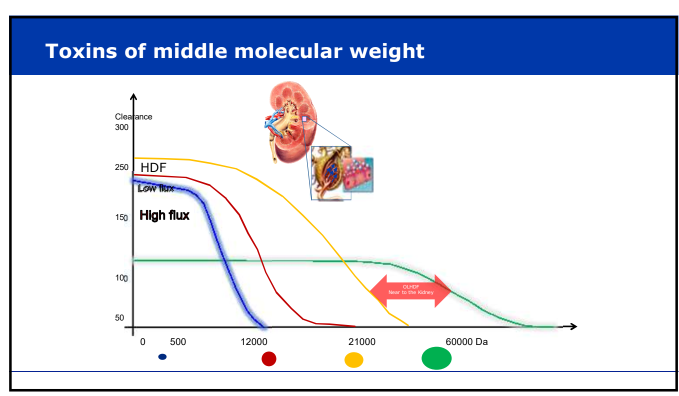


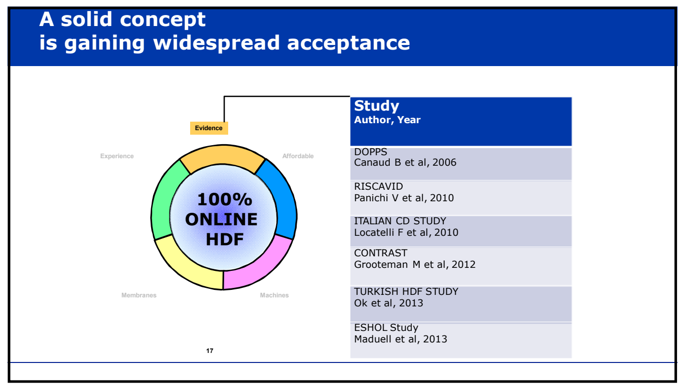


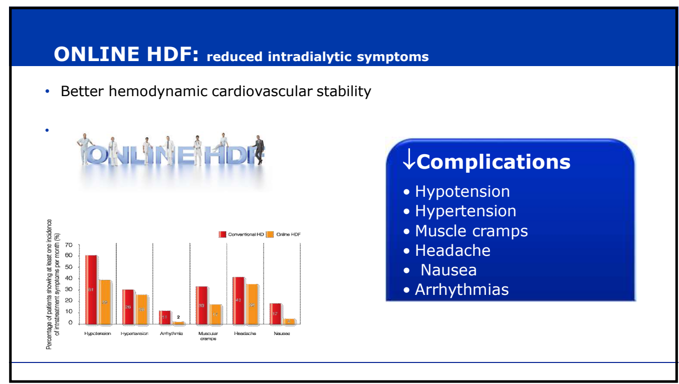


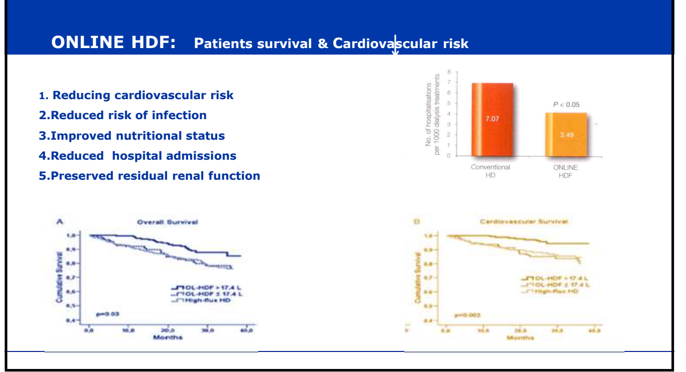
	Molecular Weight	Uremic Toxins (examples)	Low-Flux	High-Flux	HDF
			Diffusion		Convection
Small Molecular Weight (SMW)	< 500 D	**Water-soluble** (non-protein bound) urea (60D), creatinine (113)	Yes	Yes	Yes
		Protein Bound P-cresol (108D), homocysteine	No	Minimal	Yes Enhanced
Middle Molecular Weight (MMW)	500 – 12,000 D	B2m (11.8 D), AGEs (10 kDa), Parathyroid hormone (9,223D)	No	Yes Limited	Yes, Enhanced
High Molecular Weight (LMW)	>12,000 D	Leptin (16D), Complement factor D (protein 24kD)	No	No Limited	Yes

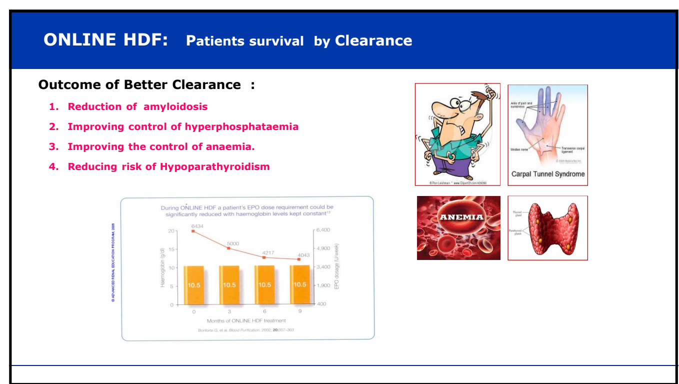


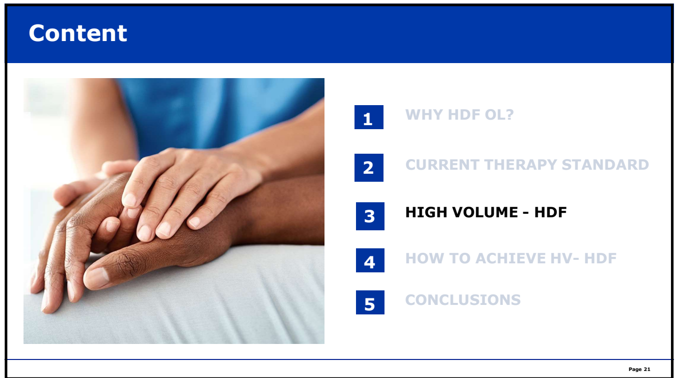


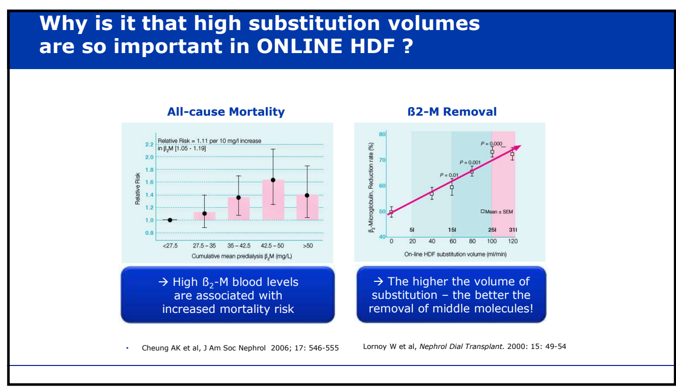

A solid concept
is gaining widespread acceptance
Evidence
Experience
Affordable
100%
ONLINE
HDF
Membranes
Machines
Study
Author, Year
DOPPS
Canaud B et al, 2006
RISCAVID
Panichi V et al, 2010
ITALIAN CD STUDY
Locatelli F et al, 2010
CONTRAST
Grooteman M et al, 2012
TURKISH HDF STUDY
Ok et al, 2013
ESHOL Study
Maduell et al, 2013
17

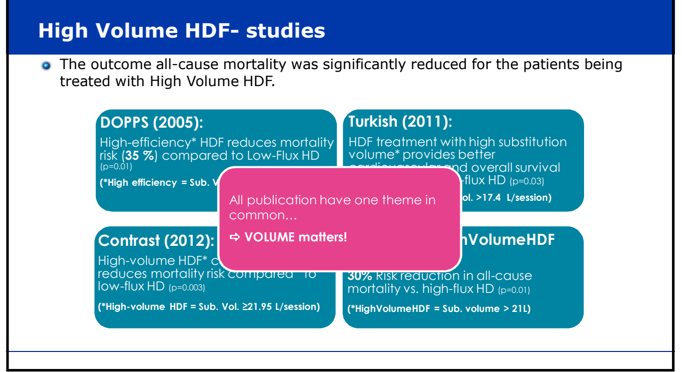

ONLINE HDF: reduced intradialytic symptoms
Better hemodynamic cardiovascular stability
↓Complications
Hypotension
Hypertension
Muscle cramps
Headache
Nausea
Arrhythmias

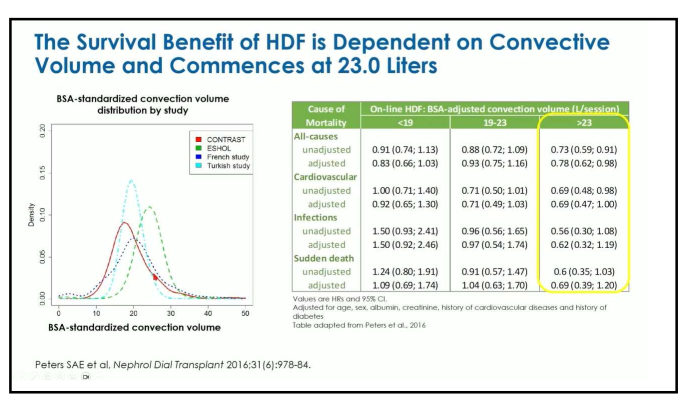

ONLINE HDF: Patients survival & Cardiovascular risk
1. Reducing cardiovascular risk
2.Reduced risk of infection
3.Improved nutritional status
4.Reduced hospital admissions
5.Preserved residual renal function
7.07
3.49
P < 0.05
Conventional HD
ONLINE HDF
Overall Survival
Cardiovascular Survival


ONLINE HDF: Patients survival by Clearance
Outcome of Better Clearance :
1. Reduction of amyloidosis
2. Improving control of hyperphosphataemia
3. Improving the control of anaemia.
4. Reducing risk of Hypoparathyroidism
Carpal Tunnel Syndrome
ANEMIA





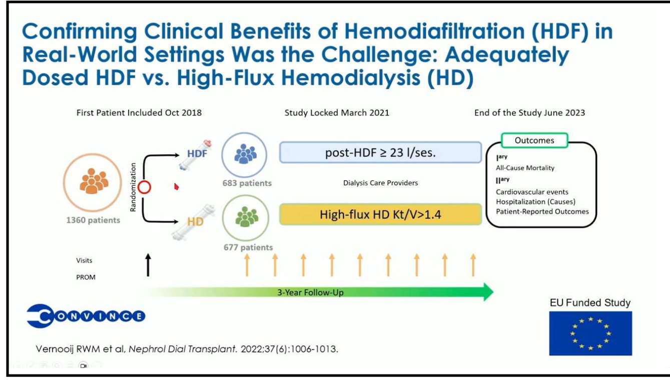


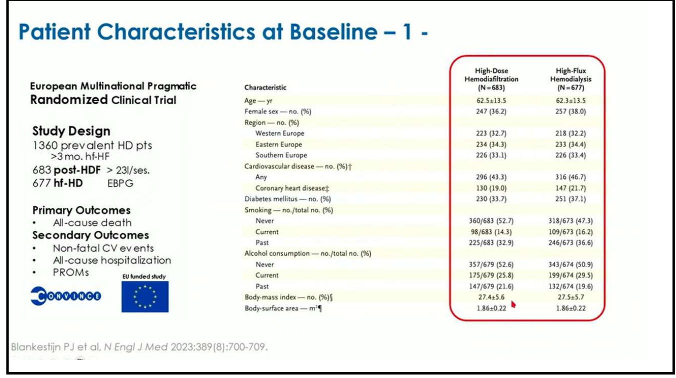


Cause of Mortality	On-line HDF: BSA-adjusted convection volume (L/session)		
	<19	19-23	>23
All-causes			
unadjusted	0.91 (0.74; 1.13)	0.88 (0.72; 1.09)	0.73 (0.59; 0.91)
adjusted	0.83 (0.66; 1.03)	0.93 (0.75; 1.16)	0.78 (0.62; 0.98)
Cardiovascular			
unadjusted	1.00 (0.71; 1.40)	0.71 (0.50; 1.01)	0.69 (0.48; 0.98)
adjusted	0.92 (0.65; 1.30)	0.71 (0.49; 1.03)	0.69 (0.47; 1.00)
Infections			
unadjusted	1.50 (0.93; 2.41)	0.96 (0.56; 1.65)	0.56 (0.30; 1.08)
adjusted	1.50 (0.92; 2.46)	0.97 (0.54; 1.74)	0.62 (0.32; 1.19)
Sudden death			
unadjusted	1.24 (0.80; 1.91)	0.91 (0.57; 1.47)	0.6 (0.35; 1.03)
adjusted	1.09 (0.69; 1.74)	1.04 (0.63; 1.70)	0.69 (0.39; 1.20)

Values are HRs and 95% CI.
Adjusted for age, sex, albumin, creatinine, history of cardiovascular diseases and history of diabetes
Table adapted from Peters et al., 2016

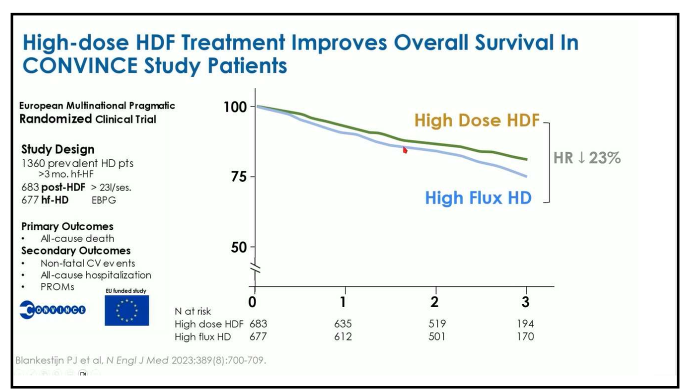
Peters SAE et al, *Nephrol Dial Transplant* 2016:31(6):978-84.

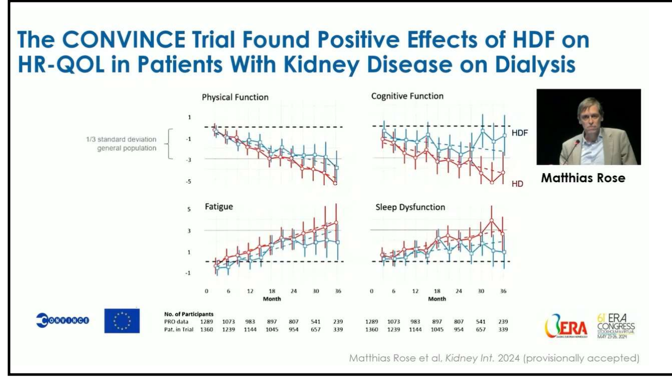


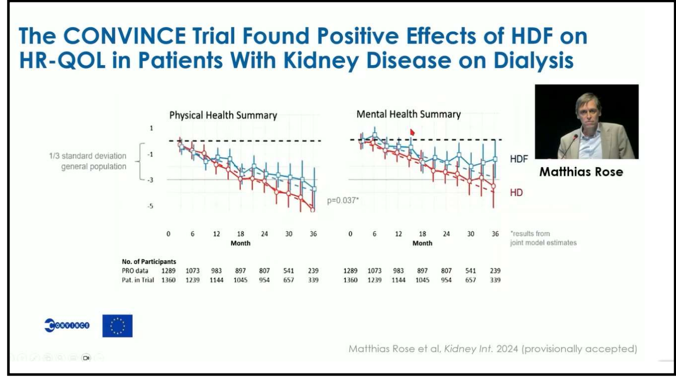


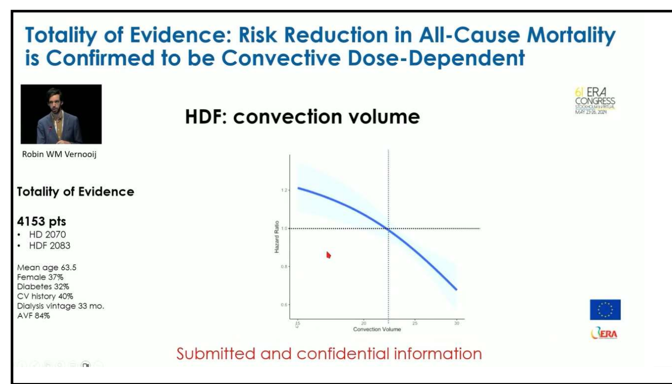
Characteristic	High-Dose Hemodiafiltration (N=683)	High-Flux Hemodialysis (N=677)
Age — yr	62.5±13.5	62.3±13.5
Female sex — no. (%)	247 (36.2)	257 (38.0)
Region — no. (%)		
Western Europe	223 (32.7)	218 (32.2)
Eastern Europe	234 (34.3)	233 (34.4)
Southern Europe	226 (33.1)	226 (33.4)
Cardiovascular disease — no. (%)†		
Any	296 (43.3)	316 (46.7)
Coronary heart disease‡	130 (19.0)	147 (21.7)
Diabetes mellitus — no. (%)	230 (33.7)	251 (37.1)
Smoking — no./total no. (%)		
Never	360/683 (52.7)	318/673 (47.3)
Current	98/683 (14.3)	109/673 (16.2)
Past	225/683 (32.9)	246/673 (36.6)
Alcohol consumption — no./total no. (%)		
Never	357/679 (52.6)	343/674 (50.9)
Current	175/679 (25.8)	199/674 (29.5)
Past	147/679 (21.6)	132/674 (19.6)
Body-mass index — no. (%)§	27.4±5.6	27.5±5.7
Body-surface area — m^2¶	1.86±0.22	1.86±0.22

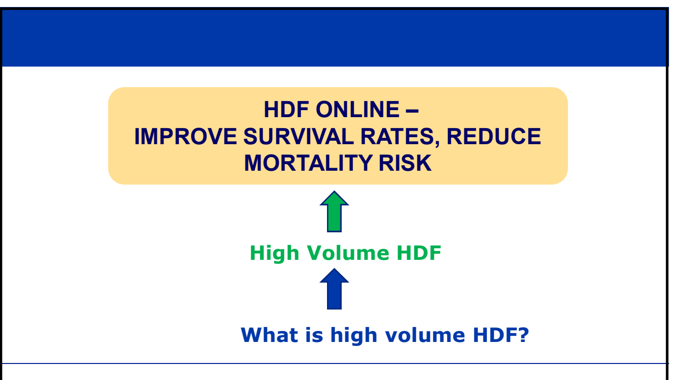
Blankestijn PJ et al. *N Engl J Med* 2023;389(8):700-709.

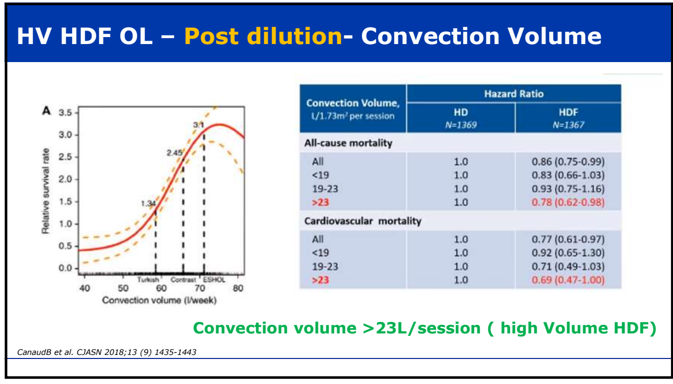



The CONVINCE Trial Found Positive Effects of HDF on HR-QOL in Patients With Kidney Disease on Dialysis
Physical Function
Cognitive Function
Fatigue
Sleep Dysfunction
HDF
HD
Matthias Rose
Matthias Rose et al. Kidney Int. 2024 (provisionally accepted)

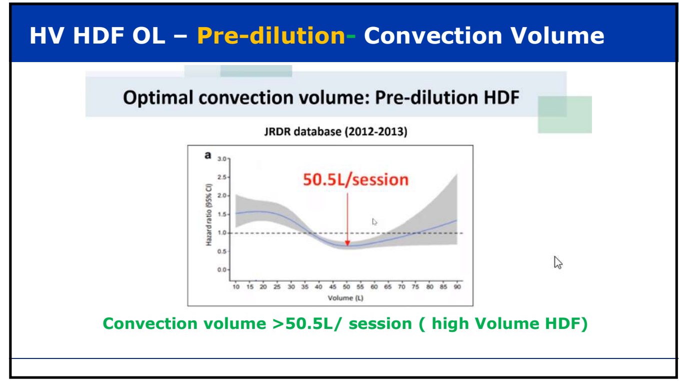

The CONVINCE Trial Found Positive Effects of HDF on HR-QOL in Patients With Kidney Disease on Dialysis
Physical Health Summary
Mental Health Summary
HDF
HD
Matthias Rose
Matthias Rose et al. Kidney Int. 2024 (provisionally accepted)

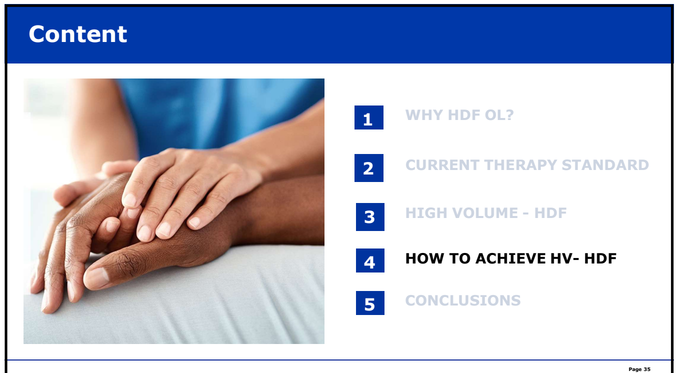

Totality of Evidence: Risk Reduction in All-Cause Mortality is Confirmed to be Convective Dose-Dependent
HDF: convection volume
Robin WM Vernooij
Totality of Evidence
4153 pts
HD 2070
HDF 2083
Submitted and confidential information

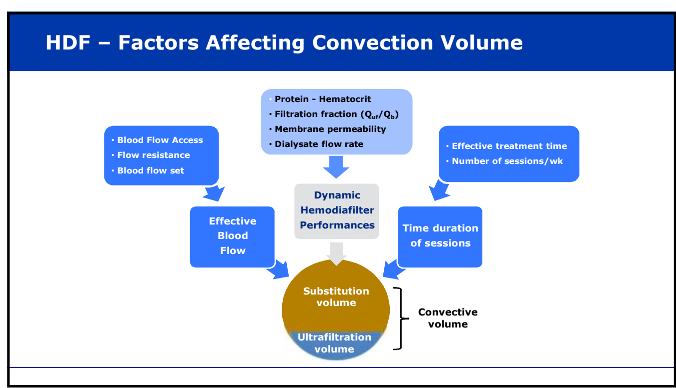

HDF ONLINE – IMPROVE SURVIVAL RATES, REDUCE MORTALITY RISK
High Volume HDF
What is high volume HDF?



Convection Volume, L/1.73m² per session	Hazard Ratio HD N=1369	HDF N=1367
All-cause mortality		
All	1.0	0.86 (0.75-0.99)
<19	1.0	0.83 (0.66-1.03)
19-23	1.0	0.93 (0.75-1.16)
>23	1.0	0.78 (0.62-0.98)
Cardiovascular mortality		
All	1.0	0.77 (0.61-0.97)
<19	1.0	0.92 (0.65-1.30)
19-23	1.0	0.71 (0.49-1.03)
>23	1.0	0.69 (0.47-1.00)







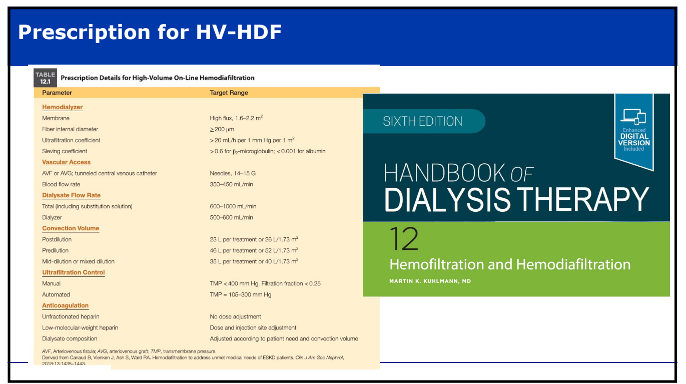


TABLE 12.1 Prescription Details for High-Volume On-Line Hemodiafiltration

Parameter	Target Range
Hemodialyzer	
Membrane	High flux, 1.6–2.2 m^2
Fiber internal diameter	≥200 µm
Ultrafiltration coefficient	>20 mL/h per 1 mm Hg per 1 m^2
Sieving coefficient	>0.6 for β_2-microglobulin; <0.001 for albumin
Vascular Access	
AVF or AVG; tunneled central venous catheter	Needles, 14–15 G
Blood flow rate	350–450 mL/min
Dialysate Flow Rate	
Total (including substitution solution)	600–1000 mL/min
Dialyzer	500–600 mL/min
Convection Volume	
Postdilution	23 L per treatment or 26 L/1.73 m^2
Predilution	46 L per treatment or 52 L/1.73 m^2
Mid-dilution or mixed dilution	35 L per treatment or 40 L/1.73 m^2
Ultrafiltration Control	
Manual	TMP <400 mm Hg. Filtration fraction <0.25
Automated	TMP = 105–300 mm Hg
Anticoagulation	
Unfractionated heparin	No dose adjustment
Low-molecular-weight heparin	Dose and injection site adjustment
Dialysate composition	Adjusted according to patient need and convection volume

AVF, Arteriovenous fistula; *AVG*, arteriovenous graft; *TMP*, transmembrane pressure.
Derived from Canaud B, Vienken J, Ash S, Ward RA. Hemodiafiltration to address unmet medical needs of ESKD patients. *Clin J Am Soc Nephrol*. 2018;13:1435–1443.