Overview of home HD strategies from around the world

Tom Cornelis

Jessa Hospital Hasselt

self-care dialysis symposium

May 12, 2016
Brussels, Belgium

Outline

- Benefits of home and high dose HD
- Risks
- Integrated home dialysis care: home HD ánd PD
- Integrated ESRD care
- Practical and financial aspects

Clinical benefits of high dose HD

	NHD	SDHD
Blood pressure	+++ (PVR reduction)	++ (ECV reduction)
LVH	+++ (afterload reduction)	++ (preload reduction)
LV systolic function	+++	?
Arterial compliance	+++	?
Sleep apnoea	+++	?
Autonomic nervous system	++	?
Phosphate	+++	f(dialysis duration)
Anaemia	++	+
Malnutrition	++	++
Inflammation	++ (CRP, IL-6)	+ (CRP)
Cognition	+	?
Fertility	++	?
Quality of life	++	++

Perl, Chan. Am J Kidney Dis 2009;54:1171–84

Benefits of high dose HD

Modality	CKD stage
Conventional HD/	5
CAPD / APD	5
SDHD (6 x 2–3h/w	4–5
NHD (3 x 8h/week	4
Frequent NHD (6 x	3
Kidney transplant	3

Survival benefits versus conventional HD

Study	Countries, duration	Intensive Home HD	In-centre CHD	Relative mortality Home HD
Johansen[1]	USA 3 years	94 pts Home NHD (5.7 d/wk)	940 pts USRDS	HR 0.36 p<0.001
Johansen[1]	USA 3 years	43 pts SDHD (5.4 d/wk)	430 pts USRDS	HR 0.64 p=NS
Marshall[2]	Australia/New Zealand 72052 patient years	865 pts frequent or extended Home HD	21184 pts	HR 0.53 p<0.05
Lockridge[3]	USA 287 patient years	87 pts Home NHD (mean 40±6 h/wk)	87121 incident pts USRDS	SMR 0.53 p=0.005 (ITT)
Nesrallah[4]	France/USA/Canada 3008 patient years	338 pts intensive Home HD (4.8 x 7.4 h/wk)	1388 pts DOPPS	HR 0.55 p=0.01 (ITT)
Weinhandl[5]	USA mean 1.8 years	1873 pts daily Home HD (5–6 sessions/wk)	9365 USRDS	HR 0.87 p<0.01 (ITT)

1. Johansen et al. Kidney Int 2009;76:984–90
2. Marshall et al. Am J Kidney Dis 2011;58:782–93
3. Lockridge, Kjellstrand. Hemodial Int 2011;15:211–8
4. Nesrallah et al. J Am Soc Nephrol 2012;23:696–705
5. Weinhandl et al. J Am Soc Nephrol 2012;23:895–904

Quality of life in home and high dose HD: background

- Increased autonomy and functionality[1]
- Reduced pill burden[2,3]
- Liberalisation of diet and fluid intake[4]
- Elimination of transport time
- Continuation of employment[5]
- Improved sleep quality[6]
- Reduction of uremic symptoms[7]
- Reduction of inflammation[8]
- …

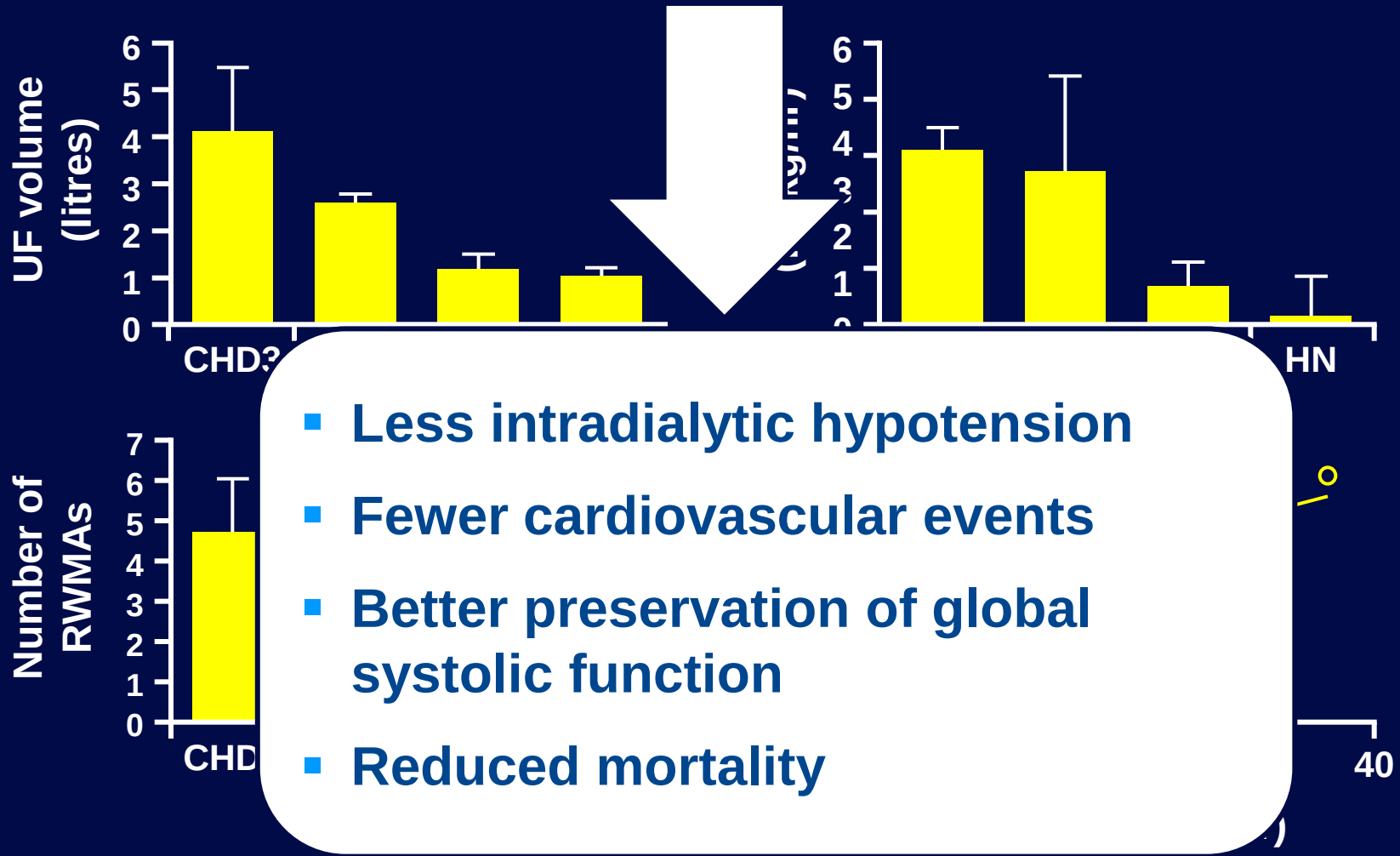
1. Hall et al. Clin J Am Soc Nephrol 2012;7:782–94; 2. Chertow et al. N Engl J Med 2010;363:2287–300;
3. Daugirdas et al. J Am Soc Nephrol 2012;23: 727–38; 4. Sikkes et al. J Ren Nutr 2009;19:494–99;
5. Pierratos. Nephrol Dial Transplant 1999;14:2385–40; 6. Pierratos et al. J Am Soc Nephrol 1997;8:169A;
7. Manohar et al. Trans Am Soc Artif Intern Organs 1981;27:604–9; 8. Ayus et al. J Am Soc Nephrol 2005;1:2778–88

Quality of life in high dose HD: data

- Improvements in kidney-specific quality of life and burden of kidney disease in multiple studies[1–4]
- Depression score (BDI) significantly improved after 12 months of SDHD in FREEDOM[5]
- Daily FHN trial: no significant change in BDI but improvement in mental health composite (p=0.007) and emotional subscale (p=0.01) scores[6]
- FHN nocturnal trial: no significant changes (due in part to small sample size) but magnitude consistent with daily FHN trial[7]

1. Manns et al. Kidney Int 2009;75:542–9
2. Finkelstein et al. Kidney Int 2012;85:561–9
3. Culleton et al. JAMA 2007;298:1291–9
4. Heidenheim et al. Am J Kidney Dis 2003;42:36–41
5. Jaber et al. Am J Kidney Dis 2010;56:531–9
6. Unruh et al. Am J Kidney Dis 2013;61:748–58
7. Rocco et al. Kidney Int 2011;80:1080–91

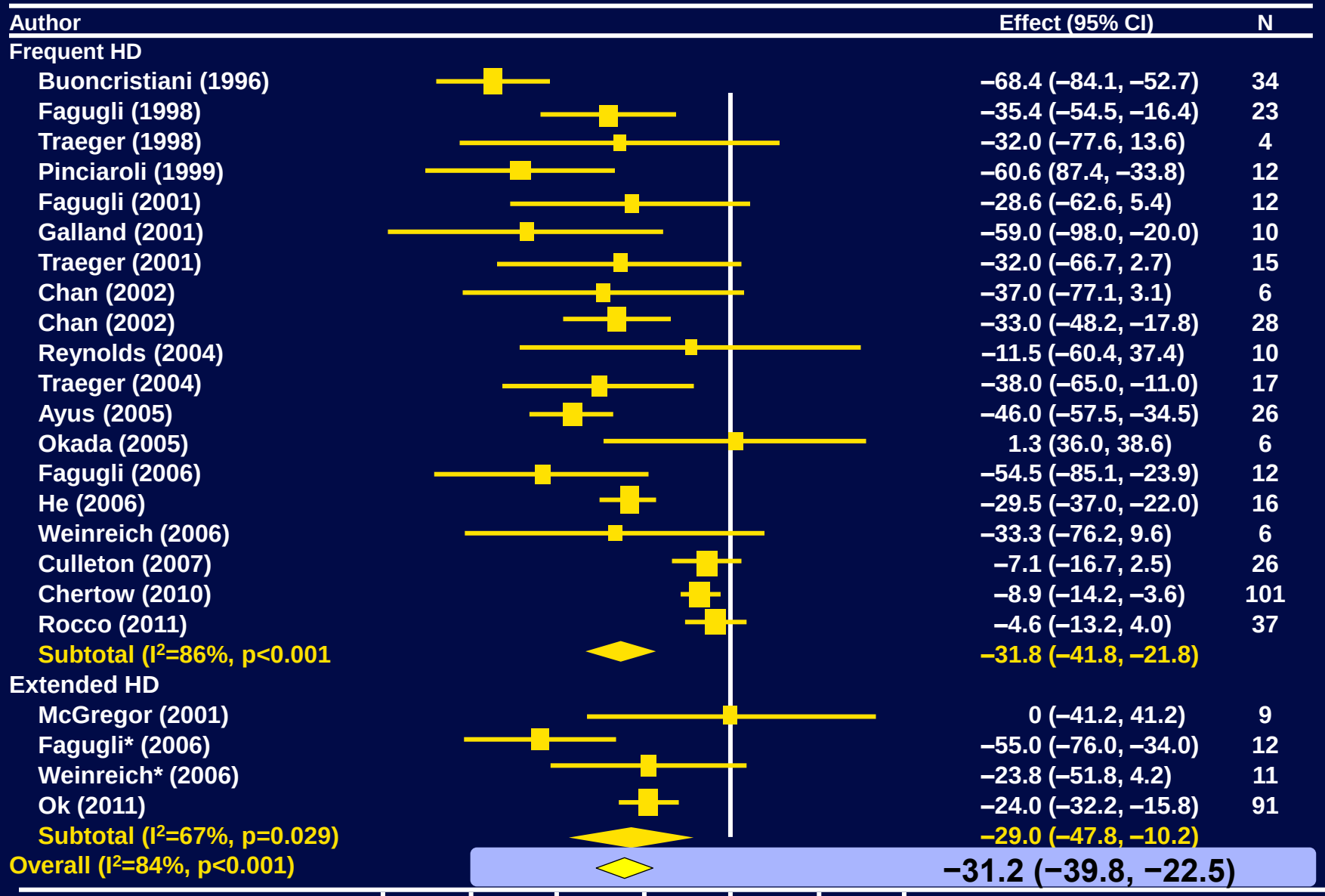
Protection against myocardial stunning



- Less intradialytic hypotension
- Fewer cardiovascular events
- Better preservation of global systolic function
- Reduced mortality

Jefferies et al. Clin J Am Soc Nephrol 2011;6:1326–32

High dose HD reduces LVH



Susantitaphong et al.
Clin J Am Soc Nephrol
2011;6:1326–32

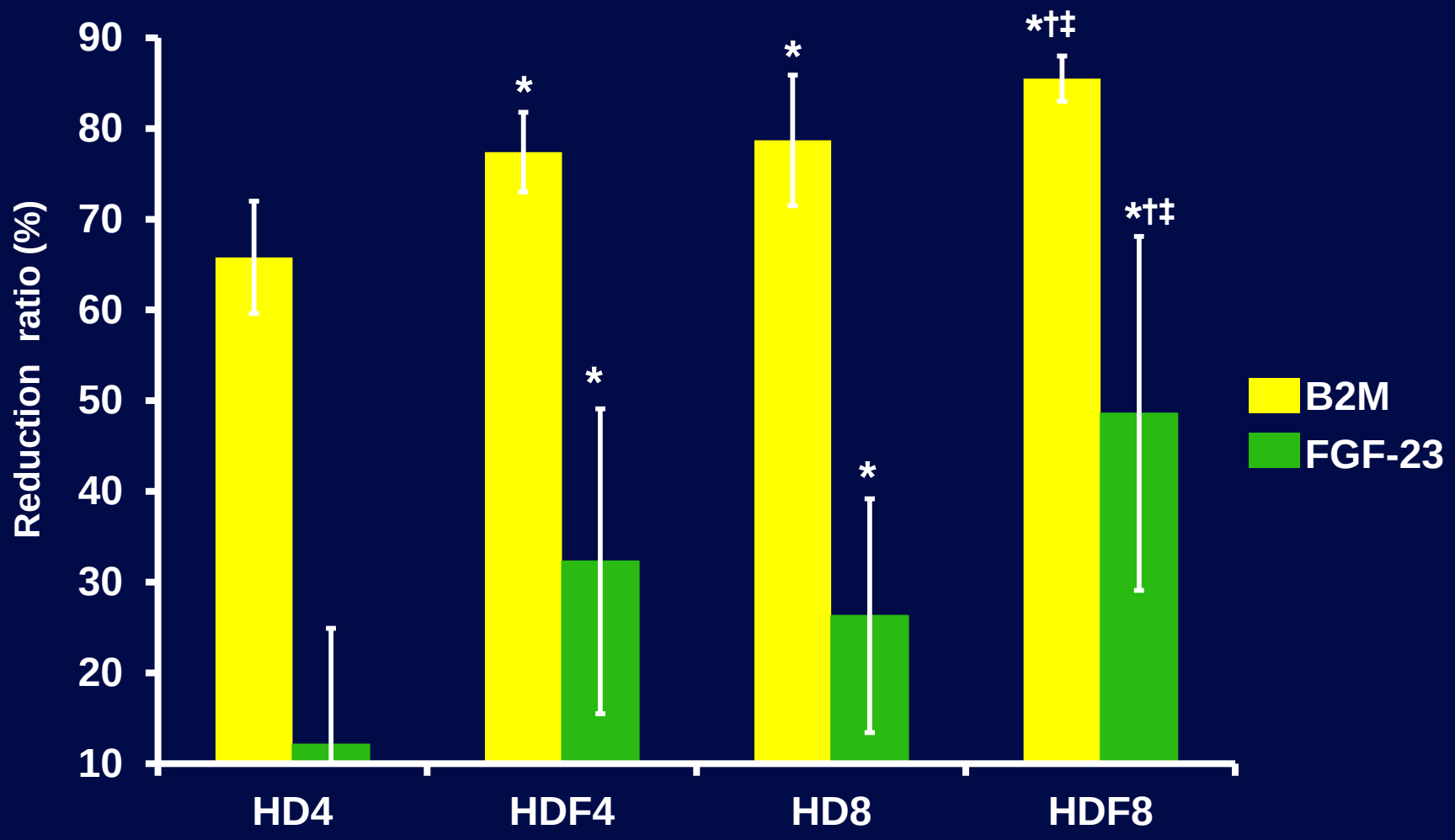
Acute hemodynamic effects in extended dialysis

Parameter	4h HD	4h HDF	8h HD	8h HDF
Peripheral SBP (mm HG)	−21.7	−23.3	−6.7*	−0.5*†
Peripheral DBP (mm HG)	−5.0	−11.5	−1.1†	−1.2†
Central SBP (mm HG)	−19.2	−24.2	−7.1	−3.8
Central DBP (mm HG)	−5.0	−12.1*	−2.6	+3.5†
CO (L/min)	−1.4	−1.6	−0.4†	−0.5†
RBV (%)	−8.1	−9.1	−4.4†	−3.3*†
ET rate (W)	−13.3	−16.2	−14.2	−14.5

*p<0.05 vs 4h HD; †p<0.05 vs 4h HDF

Cornelis T et al. Am J Kidney Dis 2014; 64:247-56

B2M and FGF-23 reduction in extended dialysis

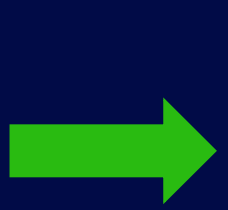


*p<0.05 vs HD4; †p<0.05 vs HDF4; ‡p<0.05 vs HD8

Cornelis T et al. Am J Kidney Dis 2014;64:247-56.

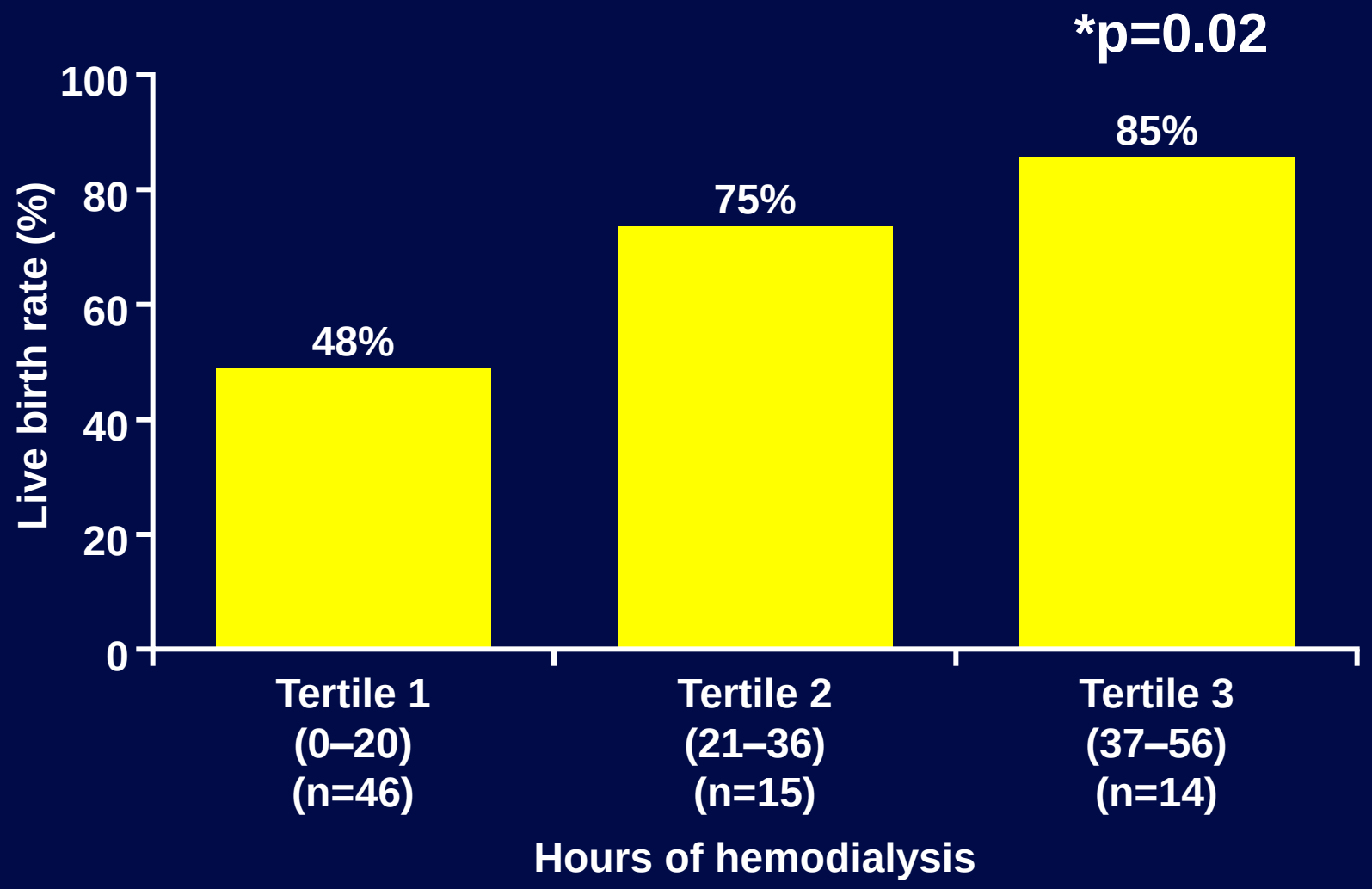
Protective effects of high dose HD in pregnancy

- Uremic toxin levels
- Peripheral vascular resistance
- Hypervolemia
- Blood pressure
- Endothelial dysfunction



Normal placental development
Reduced risk of preeclampsia
Prevention of polyhydramnios
Better feto-maternal outcomes

Improved pregnancy outcomes with high dose HD



Hladunewich et al. J Am Soc Nephrol 2014;25:1103-9.

Feasibility of home HD in elderly

- Multi-centre international cohort study: Brussels, Groningen, Helsinki, Maastricht, Manchester and Toronto
- Inclusion: patients 65 years or older at start of home HD (n=79)

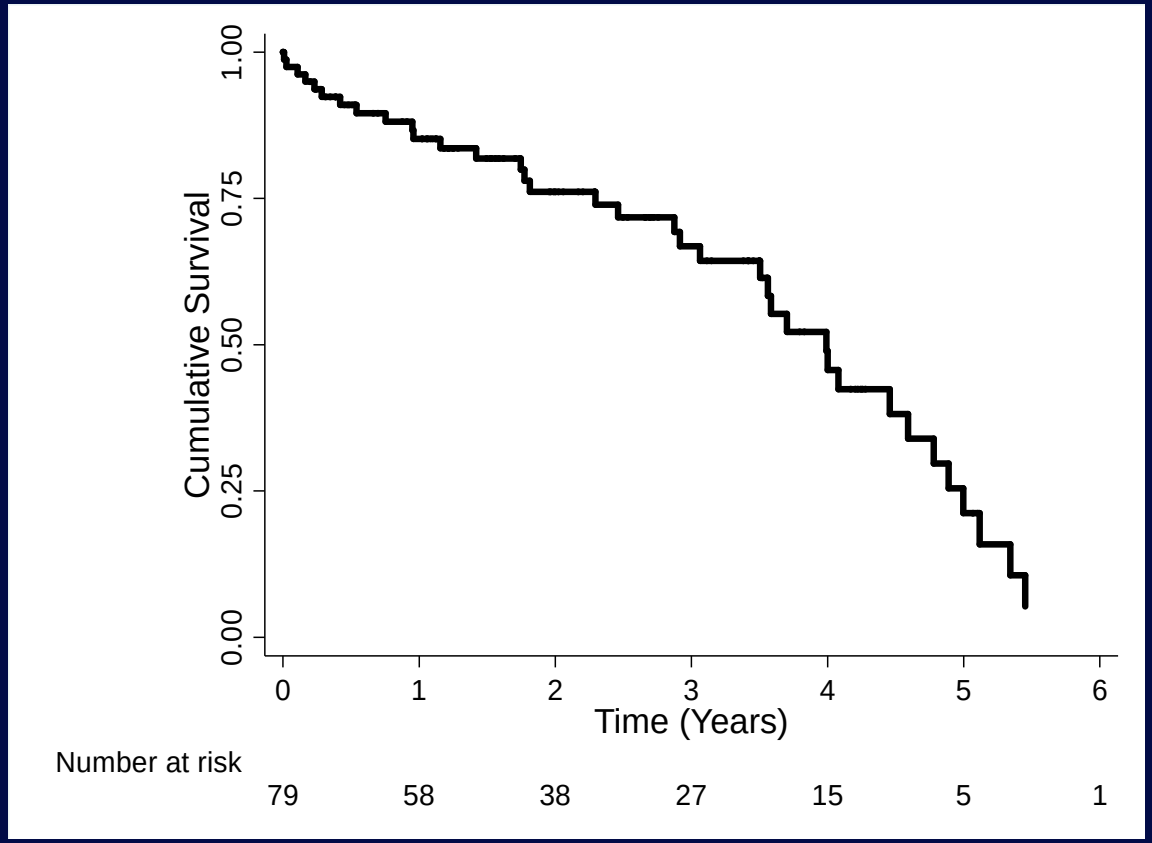
- Primary outcome: time to technique failure or death

- Secondary outcomes: time to technique failure, rates of CV events-hospitalizations-infections, vascular access interventions, need for respite care

Cornelis T et al. Nephrol Dial Transplant 2014;29:2327-33.

Primary outcome

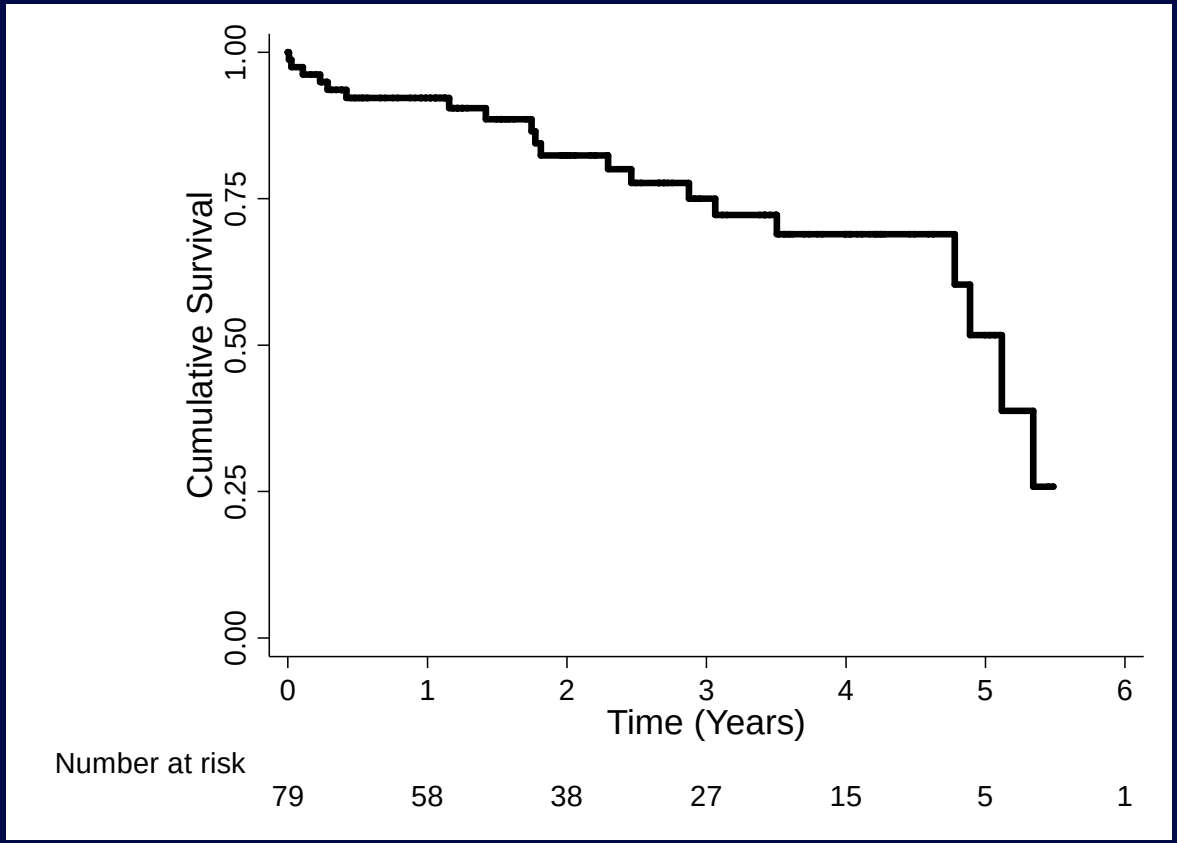
event-free survival at 1, 2 and 5 years: 85%, 77% and 24%, resp.



Cornelis T et al. Nephrol Dial Transplant 2014;29:2327-33.

Secondary outcome

technique survival at 1, 2 and 5 years: 92, 83 and 56%, resp.



Cornelis T et al. Nephrol Dial Transplant 2014;29:2327-33.

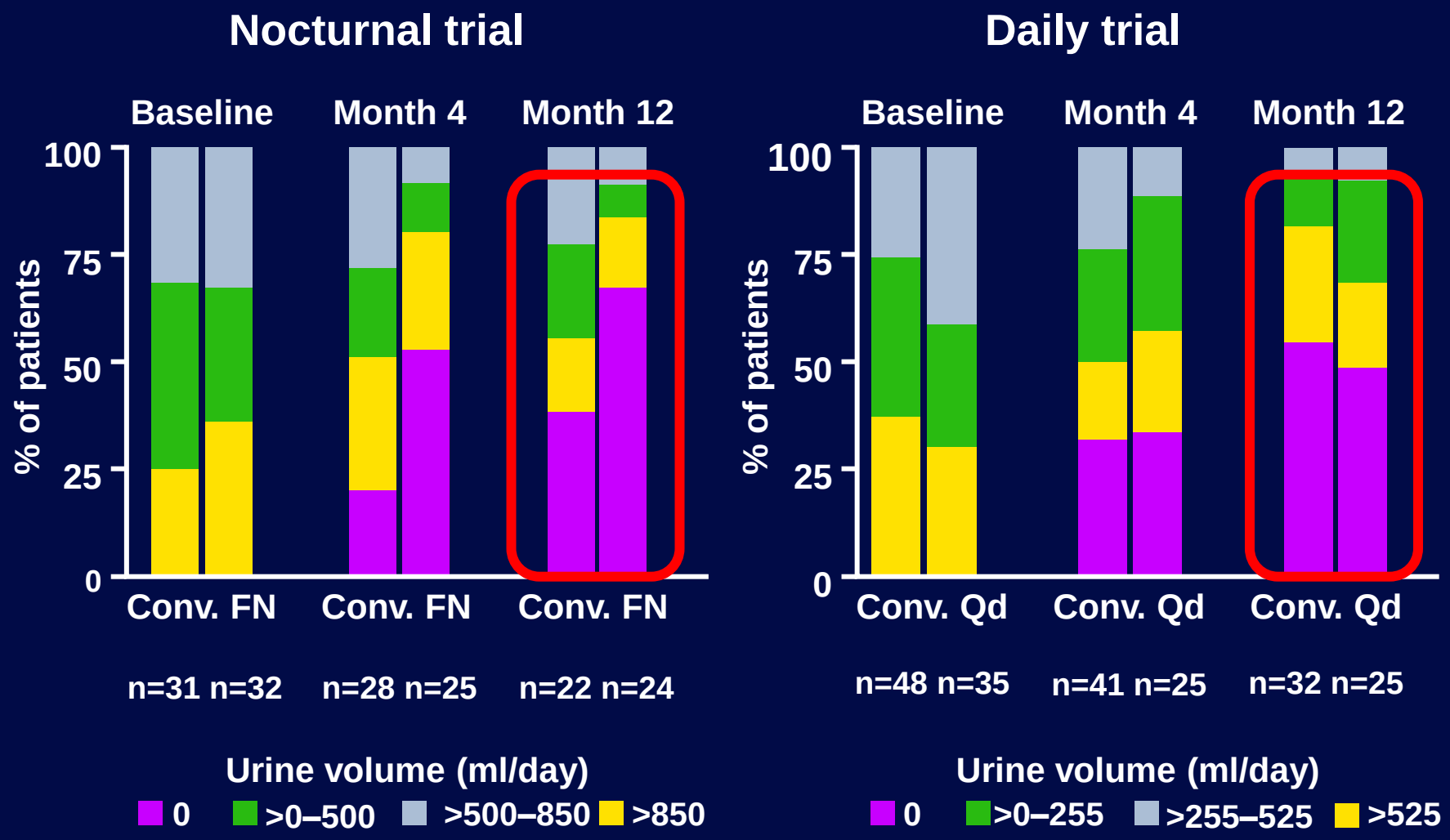
Secondary outcomes: adverse events

Variable	Value
Infections Total episodes Total rate (episodes/patient-year)	 16 **0.09**
Hospitalizations Total episodes Total rate Reasons	 103 **0.55** CV events (19), volume overload (8), infections (23), access (8)
Cardiovascular events Total episodes Total rate Reasons	 17 **0.09** MI (3), stroke (1), volume overload (8), arrhythmia (6)
Non-infectious **vascular access** events Total episodes Angioplasty/declot Permanent loss	 130 108 12
Need for **respite care**	**31/63 (49%)**

Home and high dose HD: does it all glitter?

- What about residual renal function?
- What about vascular access?
- What about adverse events in the home setting?

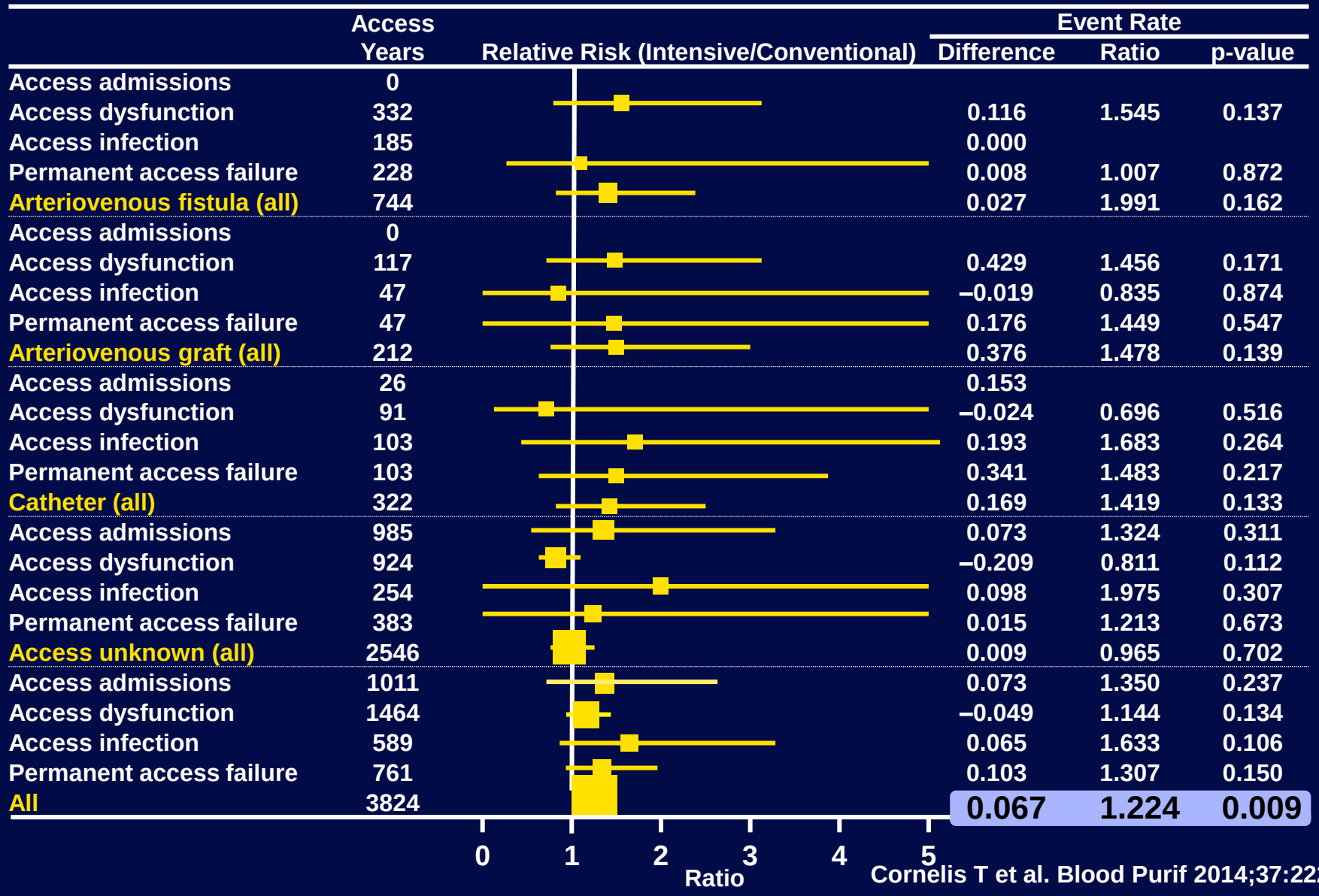
FHN: residual kidney function



Conv, conventional; FN, frequent nocturnal; Qd, daily

Daugirdas et al. Kidney Int 2013;83:949–58

Vascular access in high dose HD?



Cornelis T et al. Blood Purif 2014;37:222-8.

Adverse events in home HD

- 2 Canadian Home HD centers, 500 patient years
- 1 death and 6 potentially fatal adverse events = 0.06 events/1000 dialysis treatments
- 5/7 events human errors with lapses in protocol adherence

Wong et al. Am J Kidney Dis 2014;63:251–8

Adverse events in home HD

Need for quality assurance framework:

1. Case review
2. Technique audit of patient
3. Specific questions to programme, e.g. device defect? Human error? Change protocol? Change HD recruitment/retention?

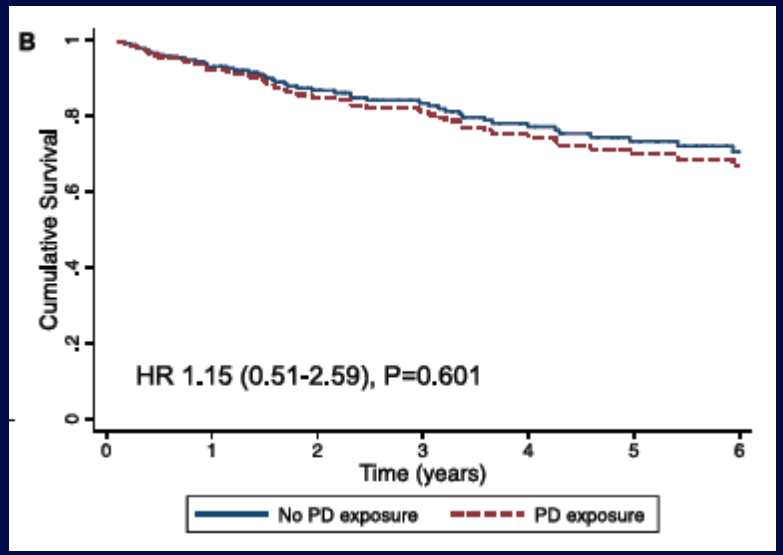
Wong et al. Am J Kidney Dis 2014;63:251–8

So…not only glitter…
What about peritoneal dialysis first?

- Home dialysis
- Comparable, if not superior, (early) survival versus facility-based HD
- Preservation of residual renal function?
- Vascular access protection
- Improvement of patient autonomy and quality of life
- Limits dialysis-related costs

Integrated home dialysis care (1)

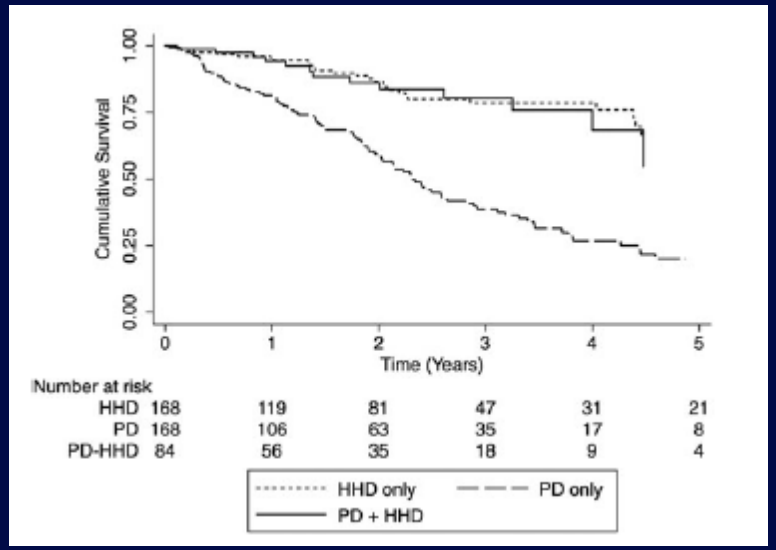
- Retrospective cohort study Toronto: outcomes of prevalent home HD patients with and without previous PD exposure
- Similar patient and technique survival in both groups, despite difference in vintage and higher co-morbidity burden



Nadeau-Fredette A-C et al. Perit Dial Int 2015;35:316-23.

Integrated home dialysis care (2)

- Observational cohort study ANZDATA: incident patients
  - PD + home HD
  - PD only
  - Home HD only
- Primary outcome: composite patient and technique survival



Nadeau-Fredette A-C et al. Nephrol Dial Transplant 2015.

Incident PD versus home HD

- Observational cohort ANZDATA: incident PD and home HD between 2000-2012
- Primary outcome: patient survival
- Secondary outcomes: composite patient and technique survival, death-censored technique survival

Table 3. Adjusted hazard ratios for secondary outcomes comparing home hemodialysis with peritoneal dialysis

Models	HR	95% CI	*P* Value
Death on specific dialysis modality (on-treatment mortality)			
Main model			
Multivariable adjustment	0.34	0.26 to 0.45	<0.001
Secondary models			
PS quintile stratification	0.34	0.25 to 0.44	<0.001
PS-matching (robust)	0.32	0.23 to 0.44	<0.001
Death or technique failure (composite outcome)			
Main model			
Multivariable adjustment[a]	0.34	0.29 to 0.40	<0.001
Secondary models			
PS quintile stratification	0.33	0.28 to 0.39	<0.001
PS-matching (robust)	0.32	0.26 to 0.38	<0.001
Technique failure only			
Main model			
Multivariable adjustment[b]	0.34	0.28 to 0.41	<0.001
Secondary models			
PS quintile stratification	0.33	0.27 to 0.40	<0.001
PS-matching (robust)	0.32	0.25 to 0.40	<0.001

Nadeau-Fredette AC et al. Clin J Am Soc Nephrol 2015.

Hospitalisation and modality failure in home dialysis

- Retrospective, USRDS
- Daily home HD versus PD versus in-centre HD
- Prevalent patients

Modality switches:

-1% daily home HD switched to PD, whereas 25% of PD switched to home HD

-15% daily home HD switched to in-centre HD compared with 44% of PD

Suri RS et al. Kidney Int 2015;88:360-8.

Timing of and preparation for transition from PD to home HD (1)

- Loss of residual kidney function
- Inadequate weekly kt/V
- Recurrent PD-related infections
- Uremic symptoms (subtle!)
- Metabolic and/or volume dysregulation
- Home visits

Timing of and preparation for transition from PD to home HD (2)

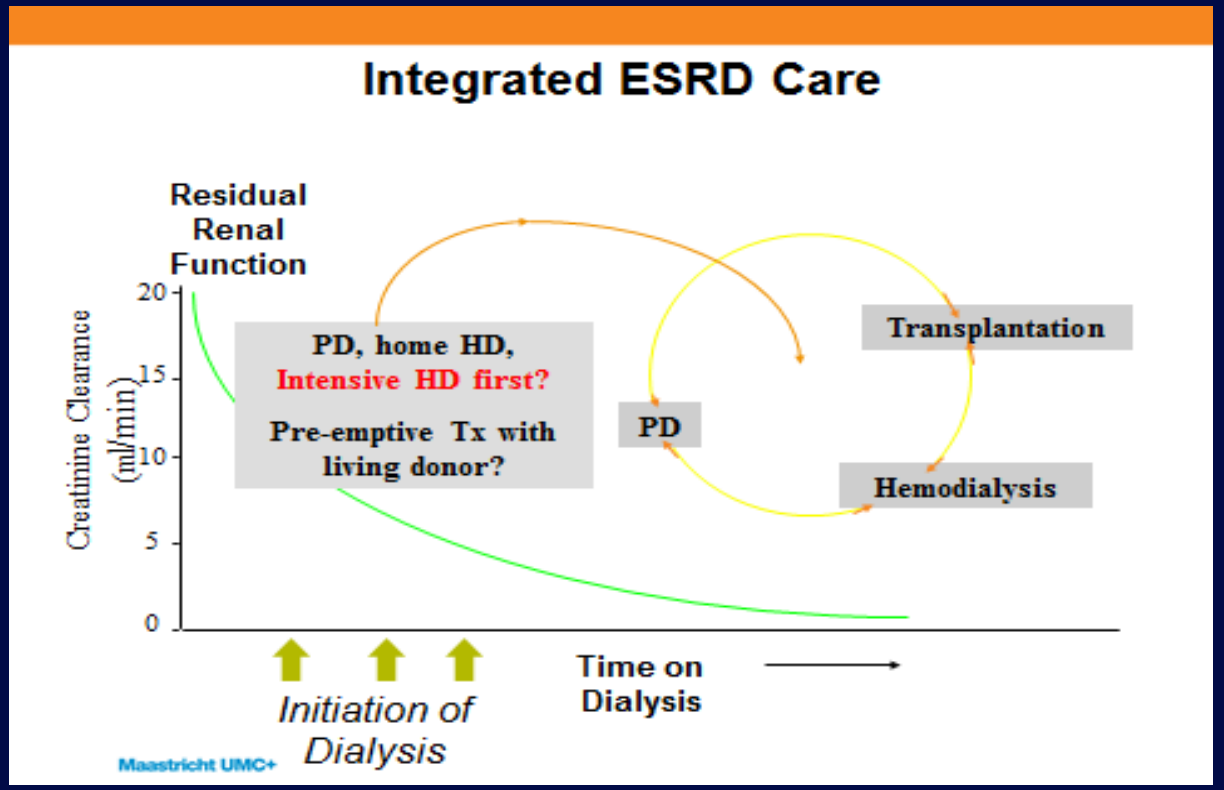
- (Pre-) dialysis education: “home dialysis first”
- Home dialysis unit
- Role of social worker, dietician, psychologist
- Patient and partner burn-out
- Timely installation

Barriers for transition PD to home HD?

- Different patients choose for PD and for home HD
- Subclinical burn-out at the end of PD?
- No separate home dialysis unit
- No timely education
- No timely installation
- Different nurses/doctor/location for PD and home HD

Integrated CKD-ESRD care:

-state of the art “CKD-ESRD chain” care
-peritoneal dialysis ánd home HD
-medical responsiveness



Also: home dialysis education e.g. fellowships!

Practical aspects of home HD

- Recognition of benefits but lack of direct experience
- Availability of practical resource to facilitate adoption
- Global Forum of Home Hemodialysis: international; nephrologists, home HD nurses, administrators, patient advocates, patient

- Open-source, web-enabled, practical manual:
  - www.ishd.org/home-hd-toolkit
- Recently published in Hemodialysis International

Practical aspects of home HD

- Funding and planning
- Workforce development
- Infrastructure, water, machines
- Cultivate suitable patients
- Patient safety: quality assurance and SAE’s
- Patient selection and training
- Vascular access
- Prescriptions of home hemodialysis
- Psychosocial aspects

Practical aspects of home HD

- How to start a home HD program?
- How to expand a home HD program?
- Home HD in Pregnancy
- Home HD in Children

How to start a home HD program?

1. Identify a clinical champion

2. Identify key team members (physician, training nurse, community nurse, equipment technician)

3. Identify potential partners/mentors

4. Develop a budget and identify sources of funds

5. Obtain legal and administrative permissions and clearances

www.ishd.org/home-hd-toolkit

How to start a home HD program?

6. Decide on the range of treatment modalities to be offered to patients (short-daily, conventional, nocturnal, etc)

7. *Strategize patient recruitment (clinical complexity, housing, social support requirements, etc)*

*8. I*dentify a location for patient training

9. Source HD machines (existing pool vs new portable machines)

10. Review program performance (eg, clinical metrics, patient-reported outcomes, cost-effectiveness, staff interest and support)

www.ishd.org/home-hd-toolkit

Health economics analysis of home HD

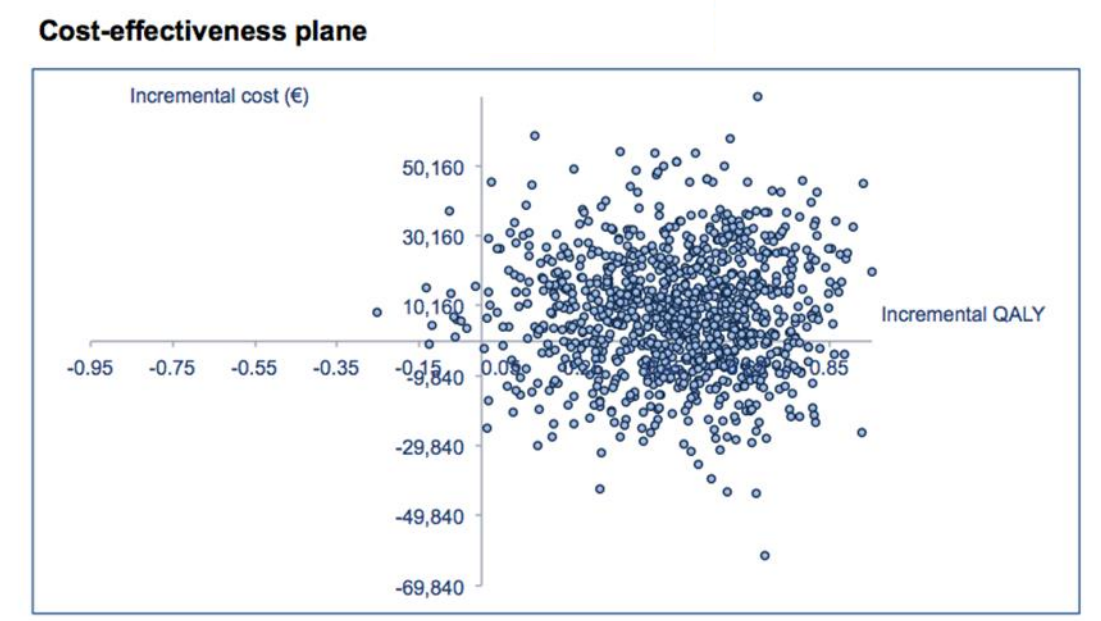
- Home HD is cost-effective compared to hospital-based HD
- Systematic review (Walker et al, Nephrology 2014)

- Economic analysis of HD in the Netherlands:
  - Markov model
  - ICER:

$$\text{Incremental Cost-Effectiveness Ratio (ICER)} = \frac{\Delta \text{ COST}}{\Delta \text{ EFFECTIVENESS}} = \frac{\text{Total cost}_{\text{high dose HD}} - \text{Total cost}_{\text{conventional ICHD}}}{\text{QALY}_{\text{high dose HD}} - \text{QALY}_{\text{conventional ICHD}}}$$

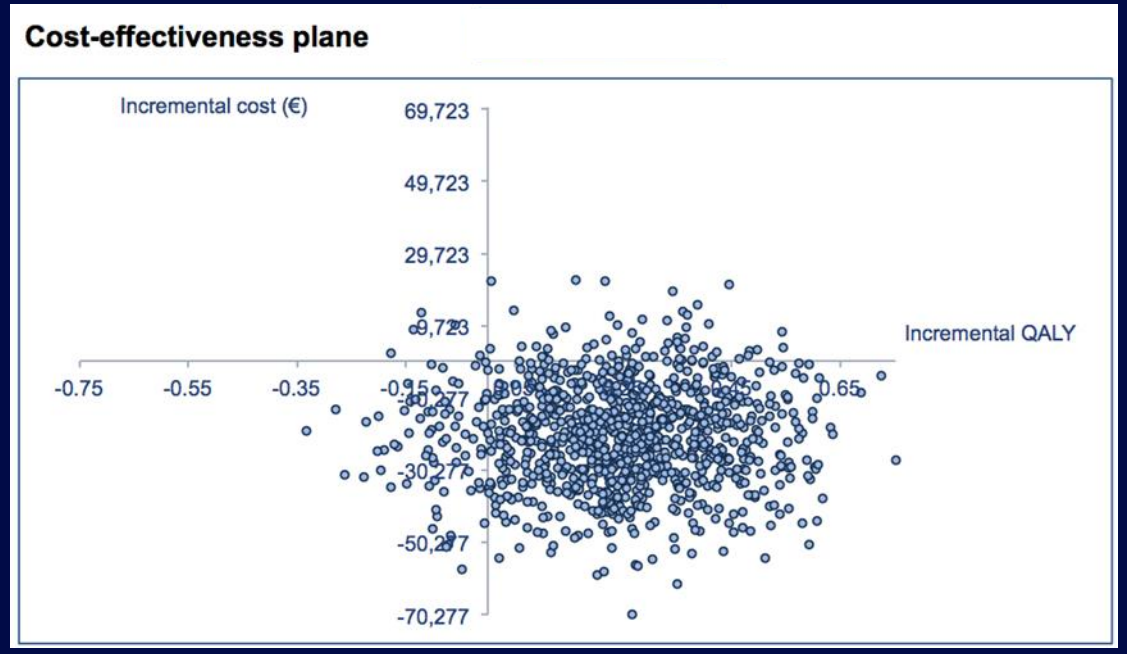
  - Conventional and high dose home HD cost-effective compared to in-centre HD

High dose home HD versus conventional in-centre HD



Beby AT, Cornelis T et al. Submitted.

Conventional home HD versus conventional in-centre HD



Beby AT, Cornelis T et al. Submitted.

Conclusions

- Home and high dose HD: indeed excellent options for our ESRD patients
- Potential adverse events should not be ignored: require attention and further study
  - Ideal candidate?
- Integrated home dialysis care: PD first, then home HD
  - Prospective studies: quality of life, dialysis access, infectious complications, residual renal function, technique and patient survival, resource utilization and health economics outcomes?
- The role of incremental dialysis needs investigation

Thank you!